

Railway
Management

UNIVERSITY OF ILLINOIS
LIBRARY

Class
385

Book
P972l

Volume

Ja 09-20M

Return this book on or before the
Latest Date stamped below.

University of Illinois Library

L161—H41

LECTURES DELIVERED BEFORE
THE STUDENTS OF

Purdue University

IN

RAILWAY ENGINEERING AND
ALLIED SUBJECTS.

1897-98.

LAFAYETTE, INDIANA,
MARCH, 1898.

385
P972ℓ

PREFACE.

American railways are entering upon a period of development the conditions of which are more exacting than any they have hitherto experienced. With an enormous expansion in the volume of traffic, with a demand for increased speed and the consequent necessity for attention to the question of safety, and with an ever-increasing competition, there is need for the highest possible efficiency in every department of railway service, and, consequently, a demand for men who are thoroughly trained for the service they are expected to render. In the future many of these men will come from the technical schools, and for this reason it seems desirable that these schools arrange courses which shall have special reference to the requirements of such service.

Purdue University has for several years offered work covering a considerable variety of railway

IV

subjects, but recently, to provide more perfectly for the railway interests, the plan of work hitherto existing has been revised, new subjects have been added, and as a logical outgrowth of this process of extension and organization, a department of railway engineering and management has been formed.

The work of the new department is sustained by all of those instructors who have hitherto been identified with the railway subjects given at Purdue, and by others who have reinforced the old organization.

But it was realized at the outset that the school could not attain the highest success unless we could bring to our aid the services of those who are in daily contact with the actual problems arising in the practical operation of the railways.

Some of the most prominent railway men in the country were appealed to, and they readily agreed to lend their aid to the enterprise. As a result we were enabled to supplement the work of the regular corps of professors by a series of lectures delivered by men high in their profes-

V

sion, representing different departments in the organization of railways, and by others versed in railway law. The lectures were found to be of such great value that it was deemed best to preserve them in permanent form; hence this volume.

CONTENTS.

	Page
I. "Problems in the Management of a Railway System,"	I
J. T. BROOKS, Second Vice-President Penn. Lines West of Pittsburg.	
II. "Railways: Their Past, Present and Future,"	61
MELVILLE E. INGALLS, President of the Big Four System, Cincinnati.	
III. "The Mutual Obligations of Railroad Corporations and the People,"	85
JOHN W. NOBLE, Ex-Secretary of Interior, St. Louis, Mo.	
IV. "Relation of Railways to the State,"	155
ADDISON C. HARRIS, Attorney at Law, Indianapolis.	
V. "Railroads and the People,"	177
ADDISON C. HARRIS.	
VI. "Railroads and Their Servants,"	199
ADDISON C. HARRIS.	
VII. "Reminiscences of a Locomotive Engineer" (<i>omitted</i>)	225
ANGUS SINCLAIR, Editor Locomotive Engineering, New York City.	

VIII

	Page
VIII. "Business Problems of the Motive Power Department,"	227
ROBERT QUAYLE, Supt. Motive Power and Machinery, C. & N. W. R'y Co., Chicago.	
IX. "Experiences in the Motive Power Departments of Railways" (<i>omitted</i>)	265
GODFREY W. RHODES, Supt. Motive Power and Machinery, C. B. & Q. R'y Co., Aurora, Ill.	
X. "Signaling,"	267
FREDERIC A. DELANO, Supt. Freight Terminals, C. B. & Q. R'y Co., Chicago.	
XI. "Car Designing and Construction,"	303
ARTHUR M. WAITT, General Master Car Builder, L. S. & M. S. R'y Co., Cleveland.	

I.

PROBLEMS IN THE MANAGEMENT OF A RAILWAY SYSTEM.

JOHN T. BROOKS.

YOU wish to know something of the practical management of railways. I might ask, How is a university or a shop managed? Universities and shops are not all managed alike, neither are all railways. The management of railways, as of shops and universities, depends on the amount of work they have to do and the kind of men who manage them. A system which controls large mileage and a large volume of traffic naturally requires more diversified and thorough organization than one whose mileage and traffic are small. When the business of a railway is not too large, an intelligent, energetic

President, aided by proper assistants, may direct all its affairs; but there are few railways whose affairs can be so managed. Generally speaking, the railway of to-day is a combination of several lines; its traffic is large; its business is closely blended with that of other lines; its income is affected by the operation of rival lines. Hence arises the necessity of organization; a classification of duties, and a general supervision of policy by a principal executive officer, details being managed by associates, each responsible for the operation of his own department.

The success of railway administration depends on two principal factors: wise policy, careful attention to details. Herein is apparent the necessity of wise men in control. The measure of their wisdom is the measure of success of the railway.

The railway system of the United States is the product of evolution.

First, in the mode of creation. Originally railway companies were created by special charter. This means that a State Legislature enacts a law declaring that the persons therein named, their

successors and assigns, are made a corporation, with power to build, operate and maintain a railway between designated points; other specific powers being granted, such as the applicants for the charter wish to have, or as the law-making power is willing to grant. Two evils resulted from this mode of creating a railway corporation; first, applicants for a charter wished to obtain special and valuable privileges, for which in many cases, they were willing to pay money. Hence resulted bribery of law-makers and sacrifice of public interests. Next, special laws creating railway companies were necessarily of great length; they conferred generally the same powers and privileges; as applications for charters became numerous, and were generally granted, the statute books became swollen to large size and many volumes. Thereupon constitutions were adopted in most States requiring all corporations to be created under general laws, and forbidding special powers to be given to any. Thus a system of laws relating to railways has been developed in nearly every State, prescribing in general terms the

mode in which all companies must be created, and the powers which all may enjoy. A corporation is spoken of as a creature of law; also as a legal entity. These terms are sometimes confusing. A corporation is a number of persons associated together for some purpose recognized by law, and permitted by law to do certain things on certain conditions. The privileges granted to persons thus associated, aside from the special object of their association, are chiefly these: They may transact business under one name, selected by themselves; they may sue and be sued in that name, and they and their successors and assigns may continue to do business for a long period or forever. The death of one member does not, as in case of a partnership, terminate the corporation. The powers and privileges enjoyed by railway companies are called franchises. This word is a mystery to many people. A franchise is merely a right, conferred by law, to do or have some particular thing.

The second step in the evolution of the railway system, consists in consolidation and the acquisi-

tion of additional lines. I have said that originally a railway company is created to build and operate a railway between designated points, as between "A" and "B." So great has been the multiplication of railways in modern times, so fierce has been the rivalry between them, so great has been the necessity of giving the public the best service at the lowest possible cost, that laws have been enacted from time to time, permitting one railway company to lease, operate or buy additional railways; also permitting two or more railway companies to consolidate and become a single company. There can be no question that the policy which permits consolidation of railway companies is a wise one. Passengers and freight can be carried long distances without change of cars, in quicker time, and at less cost; yet many people fear large railway companies, and believe newspapers and stump speakers, who say that these large companies are a menace to the people. There is no ground whatever for this fear.

A large railway company has no other or greater powers than a small one. A large company does

more business than a small company, but both do the same kind of business, in the same way. You can bring a large company into court, before a Justice of the Peace or an Alderman, as easily and as surely as a small one. No railway company however large, dares disobey the order of a magistrate. If it be said that a large railway company, in receipt of a large income, can bribe public officials, more easily than a small company, two answers may be given: First, elect officials who can not be bribed; the people always have this remedy in their hands. Second, the resources of a small railway company are ample to bribe an official, if he is willing to be bribed. The millions of a large corporation are not needed for this purpose. Put these facts to the next man you hear talking of the danger of large railroad combinations.

The third step in the evolution of the railway system is the object for which a railway is constructed. Years ago, railways were built because they were needed. People wanted easy access to markets where they wished to buy or sell;

they subscribed money, applied it as far as it would go, and borrowed what was needed to complete the railway. In modern times, many railways are built not because they are needed, but because certain men wish to make money by building them. They win or lose in proportion as they induce the public to buy the stocks and bonds they issue. It has long been the policy of the law to limit the amount of stock and bonds a railway company may issue, to the necessary and reasonable cost of construction. But the law has not yet become wise enough to limit the amount which may be issued for the purchase of a railway. Hence, the exploiters of balloon railways organize two companies: First, a railway company; second, a construction company. Then, as a railway company, they contract with themselves as a construction company, and agree, as a railway company, to issue a certain amount of bonds and stock, and deliver all these bonds and stocks to themselves, as a construction company, to pay for building the railroad. There is no relation whatever, between the cost of the railway

and the amount of bonds and stock they take for building it, except that universally the latter largely exceed the former. These promoters seldom expect to make money by operating the railroad. If they succeed in selling to an ignorant public the bonds and stock they have issued, then in a short time the public loses its money; or if the promoters do not succeed in unloading on the public their bonds and stocks, then the loss falls on themselves, and they have their railroad and their pains for nothing.

A railway once built, though yielding nothing to its owners, is seldom destroyed. It passes from one stage of reorganization to another, always on a downward scale, until it reaches a level where its income may be sufficient to keep it in operation. Meanwhile, in its efforts to avoid repeated bankruptcy, it cuts rates, carries passengers and freight at a loss, and in the process impoverishes and sometimes destroys the value of other railway properties.

Public opinion in this country has not yet reached the stage of protecting people who have

invested their money in railways which serve the public, by preventing the construction of new railways which are not needed. But people will some day see the folly of permitting speculators to take other men's land and encumber streets and highways with a useless railroad, merely to make money for themselves; and some day they may think it wise to protect the public against worthless railway stocks and bonds, as they now protect it against quack lawyers, doctors, foods and medicines.

The functions of a railway company are two-fold: First, to serve the public by carrying people and freight; second, to yield income to its owners by doing so. The public, no less than railway officials, often lose sight of the mutual duties and responsibilities which come of this relationship. The public should be well served by railway companies. This means that trains should be moved safely, punctually and at reasonable rates. On the other hand, the public should allow capital thus employed in its service to receive fair income. How many persons ever think of this?

Hostility to railways has come from a variety of sources: First, the owners of a railway are usually numerous, widely scattered and unknown. Hence, in dealing with it, the public loses the sense of personal relationship which is usually observed in dealing with individuals. Men are often restrained from doing wrong to an individual, because he is personally known, or they know that inconvenience, loss and possibly ruin, would follow their wrongful act. On the other hand, the shipper who gives false weights, the passenger who sneaks his way on a train, the tax commissioner who levies an intolerable assessment, the law-maker who in one session adds to the expenses and cuts down the income of railways, the jury that gives excessive damages against a railroad company, regard the particular theft or award they are guilty of as a mere moiety compared with the gross earnings of a railway company. They have no idea of injurious, personal loss; nor do they consider that the number of shippers, passengers, tax officials and juries who are doing precisely as they are doing is infinite, and the result to railways destructive.

Next, railways, by reason of the large capital they represent, the magnitude of their operations, the vast number of persons employed, create a jealousy of their operations which is distinctly human. The personal friendship which subsists between employer and employe when they work side by side, is wanting in the case of a railway company. In the earlier period of railways, their officers were sometimes arbitrary, inconsiderate and unjust; their employes were often careless, impudent and rude. If freight was delayed, damaged or lost, a long time elapsed before compensation was paid. When persons were injured, managers did not accept the theory of the injured party, hence arose mutterings, law suits, and revengeful feelings. Persons involved in these various mishaps did not make fine distinctions as to their causes. If brakemen were insolent, the passenger did not consider that when employes are counted by thousands it is impossible to secure a gentleman in every employe. Shippers did not consider that human beings serving as railway employes make mistakes the same as other

men; nor the more important fact, that when claims for damages amount to thousands, each must be adjusted in the order of presentation.

Gradually railway companies have emerged from the feudal stage of administration; competition has made their managers less arbitrary; organization has secured promptness in settlement of claims; experience has taught that railway companies have many points to overcome before they have an even chance with a private individual before a jury. The result is that under wiser policies lawsuits diminish in number, settlements without suit increase, and the causes of prejudice gradually disappear.

In the practical administration of a railway the daily object in view is the same as in any other kind of business—increase earnings; reduce expenses. Formerly, when railroads were local affairs, with limited mileage and traffic, the President was usually a prominent business man, banker, lawyer or capitalist. In those days business came unbidden to the company. All the latter had to do was to exercise judgment on ques-

tions of policy, aided by experts in matters of construction, operation and traffic. These primitive methods have gradually given way to changed conditions. Railways have multiplied, extended, consolidated; separate lines have been amalgamated into a single system. There is hardly a fractional point of the compass to which one or more railways is not directed; traffic no longer flows in natural channels. It is invited, solicited, bought and fought for. Under these conditions, organization, classification, subdivision of duty is the order of the day. Each department has its specially trained employes, most of them having spent their lives in railway service. Every year the management and operation of railways becomes more and more a distinct, technical profession.

A majority of railways derive from one-half to three-fourths of their earnings from freight traffic. A few, leading to summer and winter resorts or between large cities, find their main income in passenger traffic. In any event, modern conditions require a freight department and a passenger

department to secure traffic; an operating and maintaining department to haul the traffic; a treasury department to receive and keep the money that is earned; an accounting department to show whence the money comes and whither it should go, and a law department to give daily and hourly advice, prepare deeds, contracts and mortgages, and especially protect the company's rights when the same are involved in litigation.

For the purpose of securing traffic the freight and passenger departments are conducted on a basis similar to that of wholesale commercial houses. Territory in which the system is located, territory beyond either terminal and on either side of the main line, is divided into districts, each in charge of division agents, each supplied with solicitors for traffic, who travel from town to town, from city to city, and in cities from house to house, in search of persons who wish to travel or have something carried. This army of men working to secure traffic is in hourly communication with superior officers by mail, telegraph and telephone. The typical passenger agent persuades people to

travel by his line who neither wish nor need to travel. The typical freight agent represents a line which carries so safely, swiftly and cheaply ahead of all competitors that even dead freight rejoices in the prospect of traveling over it. Sometimes the cost of securing traffic exceeds all income that is derived from carrying it.

Closely allied to the question of earning money is the question of earning it at least possible cost. Herein are involved matters of operation and maintenance. The pole star of train movement is high speed and safety. Transportation is merely means to an end. A person at A. has business at B.; he wants to go from A. to B. as fast as he can and get back as soon as he can, but he wants to go and come without injury. Freight traffic not wanted at A. is wanted at B. Capital invested in it is idle till it reaches destination. On the other hand, engines and cars are unproductive when not in motion, and the loss is great unless trains move safely. A thousand conditions are essential to secure speed and safety. It is not difficult to get engines whose capacity for speed

will meet the wishes of all. The obstacles are in the track, in grades which limit the speed of movement, in curves which increase the distance to be traveled. The nearer a track approaches a straight and level line the greater the possibilities of success in both speed and safety. But while a railroad once straight is always straight, a railroad once level is not always level. Rain, frost, continuous and heavy pounding of trains perpetually cause defects in the track. These defects must be perpetually repaired; otherwise, costly engines and cars are injured, and liability to more costly accidents ensues. A good track is, therefore, the indispensable condition of success.

I have said that engines and cars are unproductive when not in motion. Their profit is also diminished by slow movement; a small amount of equipment, efficiently handled, answers the purpose of a large amount inefficiently handled. In this connection, it is also important that cars should be quickly loaded and unloaded. The daily mileage of a freight car is an indication of the efficiency with which it is handled. A few

years ago, the average daily mileage of these cars on certain railways was between fifty and sixty miles ; on the same railways, it has declined in some instances to between twenty and thirty miles. Part of this reduction is due to poor management ; a greater part is due to causes which can not be controlled. For want of adequate facilities at large cities or terminal stations, loaded and empty cars are detained days and even weeks, waiting to receive or discharge their burden. This evil is to some extent overcome by the modern system of demurrage, under which a nominal charge of a dollar or two per day is made when cars are detained beyond a specified time.

Speed and safety are not the only requisites of successful railroad operation. It is essential in movement of freight traffic, that the greatest possible number of tons should be carried by each train. I think it may be said that the most interesting and complex problem in freight movement is to constantly increase the number of tons per train ; each train must have one engine and staff of men—engineer, fireman, conductor, brakemen.

It is easily seen that the more freight this outfit can safely carry, the greater is the profit. Observe now what is developed in order to secure this important result. Large engines take the place of smaller ones; a heavier load can be hauled over a light than a heavy grade; therefore grades are reduced to the lowest possible limit. To make this work effective, it is sometimes necessary to reduce only the highest, or, as it is called, the ruling grade, to attain the desired level; at other times, a number of lighter grades may be reduced, the number of cars or tons per train increased, and the increased load carried over the ruling grade by aid of an extra engine. Sometimes the expense of reducing grades is so great that in view of the amount of traffic, it is not profitable to change them. The expediency of the proposed change is determined by the civil engineer, who reports the cost of the proposed change, and the manager, who calculates what he can save by the increased tonnage per train. It is a pure question of mathematics, and, as I have said, an interesting and important one.

The larger engine needed to haul heavier trains calls for stronger bridges and heavier rails. The longer trains call for longer sidings; main tracks are doubled and trebled; additional right of way must be bought, freight stations and platforms must be enlarged.

Time does not permit a closer examination of these details. Suffice it to say the brightest minds are ever on the alert to devise new means to increase the tonnage per train and reduce the cost of operation and maintenance. In this respect the highest encouragement is afforded to students of technical schools, like Purdue University. The graduate of one of these schools, armed with a diploma and clothed in overalls, can make rapid progress in a railroad shop and soon find a place where honorable employment and sure pay will attend him as long as health and life are spared. The maintenance of track is no longer, as formerly, confided to supervisors who have been used to pick and shovel, and accustomed to work and direct by the rule of thumb or jolt. That most important work is now performed by trained civil

engineers, who bring to their daily task the best and latest methods of their profession.

A railway company having effected plans to secure traffic and carry it cheaply and safely, must next provide that the money earned shall be received and properly applied; hence exist the accounting and treasury departments. The former tells whence every dollar of revenue should come and how it should be applied; the latter receives and pays the cash.

The operations of a railway are hardly less destructive than those of war. Materials are necessarily consumed daily as if they were cast into a fiery furnace. In spite of all precaution structures give away, trains are wrecked, property is injured, limb and life are destroyed; wages accrue every day; interest on bonds grows every day in the week and every hour of the day. Payments on these accounts must be made every day, and unless there is an inexorable system of securing daily the money which has been earned the movement of trains must cease.

The earnings of a railway company come from persons counted by tens and hundreds of thousands; classification makes the problem simple. This army of persons is made up of passengers, shippers of freight, station agents, conductors; also treasury officials who receive large sums due on interchange of business; also on contracts with other railway companies, express and sleeping car companies and the government. Passengers must pay in advance for the service they receive, either in purchase of a ticket from the station agent, or in cash to the train conductor; shippers of freight or consignees must pay for freight carried before it is delivered at destination. Conductors are required to deliver cash collected at the end of each trip; station agents must remit each day the cash receipts of that day. By means of a thorough system of accounting the use of way bills, manifests, daily reports, etc., the accounting department can tell to a dollar how much money each station agent or other receiving agent of the company should remit, and he is charged with that amount. Traveling auditors

call often and at unexpected times to examine the accounts of agents. Between these calls it is possible for an agent to manipulate his accounts, accumulate a considerable sum of money and run away with it. To protect the company in cases of this kind every receiving agent is required to give bond for good behavior. No ingenuity has yet been able to devise a perfect check on the accounts of a conductor who collects cash fares on a train. As railway systems become enlarged and the magnitude of their operations attracts public attention, railway employes naturally acquire a higher sense of duty and honor. To this cause equally with the thorough organization of the accounting department, which makes the discovery and punishment of dishonesty almost certain, is to be attributed the success of railway companies in collecting their vast revenues. Hundreds of millions may be involved, and not a case of embezzlement occur in years.

The relation of a law department to a railway company is so apparent that it is hardly necessary to define it. The law holds railway companies to

a high degree of responsibility, and with few exceptions, makes them liable for acts of their employes, and for the character and condition of track, tools, machinery and equipment. The high speed at which trains are moved causes accidents to employes, passengers and people and domestic animals on the track. The movement of heavy engines and cars in yards and on side tracks, the shifting, coupling and uncoupling of cars in making and dismembering trains, is a prolific cause of injury which can not be avoided. In spite of thorough organization and rigid rules for the inspection of track, engines, cars and machinery, passengers and employes are injured. Freight is delayed, injured, stolen or destroyed. Passengers are ejected from trains. Defective culverts and drains cause water to accumulate on adjacent land. Sparks from engines kindle fire in adjoining fields; claims and suits for damages are always pending, based on the accidents and injuries enumerated. It is the duty of the law department to protect the company in cases of this kind. It also begins suits to condemn addi-

tional lands, to enforce the company's contracts, to protect it against unlawful taxes and assessments threatened by city, township, county and State authority. It assists in prosecution of persons who have committed crime against the property, employes and patrons of the company. It is also called upon hourly to prepare contracts, deeds, leases, mortgages, and to give advice to officers and employes in respect to their duties and the rights of the company. The organization of the law department of a railway company depends on the magnitude of the company's operations. Usually there is a general counsel, aided by assistants, clerks and stenographers at the general offices of the company, and the territory in which the railways of the system are situated is divided into districts, each in charge of a regular solicitor. It is the duty of district solicitors to prosecute and defend in all civil causes arising in their respective districts, also to attend coroner's inquests when persons have been killed by trains; also to represent the company before city, township and county authorities

in matters where the company's interests are the subject of consideration.

A prominent feature in a modern railway system is the department of claims. The destructive character of the operation of a railway creates so many claims for damage that it has been found expedient to establish a special department to adjust these claims. To this department reports by wire and mail are promptly made of all cases of personal injury and death, in order that experts may at once investigate the cause of the accident, gather proof, name and address of witnesses, and in cases where the company is liable, arrange a speedy and satisfactory settlement. In many cities there are attorneys who give special attention to what are known as personal injury and death claims against railway companies. They read newspapers carefully to get early information of railroad accidents. If persons are injured or killed they go or send an agent to the injured person, or in case of death, to the house of mourning, and offer their services to bring suit against the railway company. Sometimes they

go to the family of a deceased person before the funeral has taken place. Sometimes they begin suit for damages in behalf of persons who have not employed them. It is not surprising to know that attorneys like these rob their clients of from one-third to one-half of all they collect, charging for their unimportant services of a few hours as much as an injured person receives who spends the remainder of his life a cripple, or as much as a family receives which has been bereft of a husband or father. To guard against outrages of this kind the claim department, with its thoroughly equipped agents, makes speedy investigation of every accident, and in cases of liability promptly tenders compensation for the injury it has caused. By this arrangement those who have suffered injury receive compensation, avoid the exactions of attorneys, and the slow and vexatious course of legal proceedings. This work is both politic and humane, and tends to relieve railway companies of much of the prejudice which has arisen against them.

I have spoken of the classification of the business of a railway system and its distribution among various departments. Something remains to be said of the general policy of its management. Reference has already been made to the gradual enlargement of different systems of railways; the large increase of mileage and the vast amount of capital involved in their operations. Several leading railways have their eastern termini on the Atlantic coast line, and extending westward across several States, have western termini on the great lakes; also on rivers which find an outlet in the Gulf of Mexico. Their operations are subject to control by State and Federal authority. They are in ceaseless competition with each other. Traffic of the same kind moves in opposite directions on the same line. Their own traffic at one point is in competition with the same kind of traffic at another point. This traffic is local, interstate and international, each demanding consideration peculiar to itself. These various lines are operated on unequal conditions. One has the longest distance; another has easier grades; a third has

cheaper fuel; a fourth traverses a populous country; another has little traffic, except between terminal stations. Some have no rival lines at important centers of trade; others have from two to a dozen competitors at one or more terminal points. One company is burdened with a heavy debt; its rival has moderate interest charges. As a result of all these varieties of condition, the cost of moving traffic is not the same to any two companies. Except on rare occasions, the supply of railway service is largely in excess of the demand. Back of all is the ever aggressive greed of the large shipper, whose custom every railway wants, and is given to the railway which will charge the least for its service. Every hour of the traffic manager's life is afflicted with news that a valued patron has been persuaded to ship by another line, or can be retained only by a deep reduction of rates, involving a loss of revenue to the railway company amounting to hundreds, thousands, tens of thousands and even hundreds of thousands of dollars in a single case. These troubles are incident to the mere acquisition and preservation of

traffic ; they are incessant, corroding and destructive ; they turn men's hair gray, smite them with palsy and drive them to early graves.

In the intervals between losing traffic and buying it back at deadly cost, how is the railway management occupied? Lands must be bought for additional right of way and depot facilities. Shippers want side tracks to their elevators, warehouses and shops ; coal operators, stone quarriers, furnace men want branch lines built ; connecting railways want a joint use of tracks and facilities ; weak holders of worthless railroads want to sell them ; new lines must be built to protect those already owned ; old employes want pensions ; myriads of outsiders want employment ; village councils want street crossings lighted ; city councils want to pave streets, establish sewers, secure new railways and give bounties to manufacturers, largely at the expense of railways ; others demand change of grade of tracks, elevated tracks, viaducts, and sometimes order to destruction one kind of improvement they have ordered to be built, before it is paid for, to make way for another

which will better please their taste or gratify their revenge. People along the line want every convenience at stations. Boomers of towns and cities want special train service. Lawmakers want to give everything that is asked for against railways, and men in every department of public service, village, city, county, State and Federal, want to ride free; not all, but nearly all, and not merely for themselves, but for their families, friends and companions; meanwhile, old debts are maturing and new bonds and mortgages must be created. Current interest and other obligations must be met. No one would expect that in this increase of burdens and decrease of income railways could continue to be solvent. I might with truth add that, except the security holders, no one would care; and the fact justifies the expectation; within two years last past more than twenty-five per cent. of the total railway mileage of the United States has been in the hands of receivers. To cap the climax, at a time when railroad property is most worthless; when more than one-half the capital invested in railways is unproductive, there

are people who want to lay heavier burdens upon them, reduce still further their income, and increase the taxes which are levied upon them.

The people of the United States are just, and if they know the facts, they are not willing to be guilty of injustice. They will concede that capital honestly invested should yield reasonable income; especially are they willing that the man who serves them should be compensated for that service; no one will deny that railway companies render service to the public. They carry people, freight, express, parcels, newspapers and letters; no inconvenience can be imagined which would affect so large a body of people as that which would result if railway trains should cease to move. Burdens imposed by Legislatures, taxes levied by tax commissioners would not be excessive if it were known that these burdens and taxes were too severe. Law-makers would not reduce the income of railways, nor would they forbid railway companies to make arrangements with each other to protect their income, if they believed the income so protected were necessary to properly operate

and maintain these railways, and, in addition, yield a fair dividend to stockholders. The fact is that, at this time, one-third of all railway bonds in the United States are in default of interest, and more than two-thirds of all railway stocks yield no dividend. The aggregate amount of these bonds and stocks in default is between five and six billion dollars, and every one of the railways^s is in operation, serving the public, and more than half of them receiving no pay for the service.

The blame of this situation rests not wholly on the public. The public can no more guarantee profit to all railways than to all mills or farms. Many railways were built, not because they were needed, but because exploiters wished to make money in building them. Others were built in good faith, but in bad judgment, hence predestined to bankruptcy; nevertheless, railways built by exploiters and those built by men of bad judgment, no less than those which were built for an honest purpose and in good judgment, serve the public unceasingly, by carrying them and their freight,

their newspapers and their letters. What is the duty of the public toward them?

The first duty of the public towards railways is to deal with them with knowledge, not in ignorance; with reason, not in prejudice. How many people know that recently twenty-five per cent. of the entire railway mileage of the country was in bankruptcy? How many know that one-half the money invested in American railways yields not a cent to its owners? This knowledge should, and will when it prevails, convince people that railways are not earning too much money. Many people believe that railway property is not taxed, or if taxed, not taxed enough. They learn this from newspapers and street talkers. Go to the Treasurer's office in any township, city or county in the State; ask your servant, the Treasurer, what is the fact; you ought to be willing to believe him. If you think railway companies are earning too much money, go to another high servant of yours, the Auditor of State; ask him to tell you how many railway companies in the State have been bankrupt, how many pay dividends to

stockholders and interest to bondholders ; ask him and ask the Governor to tell you if they think the railways in Indiana earn too much money, and if they say yes, ask them to specify what companies they refer to, and tell how much they earn and how much less they ought to earn. In this way you will get knowledge, and no longer act in ignorance.

Prejudice is an intangible, impalpable, invisible enemy, most difficult to conquer ; a vague impression, derived from unworthy or unreliable sources. The longer it exists in the mind the stronger it becomes, and as it rests not in reason, but wholly in ignorance, you can not assail it with reason. There is no hope for the case unless it is willing to learn facts and become enlightened.

A prejudice exists against railways. They are feared because times and conditions have consolidated them into large systems. But why do you fear a large railway more than a small railway ? Do you think a thousand miles of track under one control more formidable than a hundred miles, or ten ? Is a long train of cars more dangerous to

your liberties than a short train ? Is a spacious, airy, well furnished car a menace to your rights ? Surely danger does not lie in the number or length of rails, or trains, or the furnishing of a car. Do you fear that large railways will set themselves above the law or defy the courts ? Go to any Justice of the Peace in any township, in any State in which is situated the largest railway in America, ask that Justice of the Peace if he has any difficulty in bringing that colossal railway company into his little forum ; he will answer, " Not a bit. I send the constable with a little piece of paper, telling the company to come before me and it comes." Ask any prosecuting attorney in any county in America whether he has any difficulty in indicting or punishing a railway company or employe for a crime ? He will tell you, " Not any more than in case of individuals." Do you fear the influence of large railway companies more than small companies in corrupting juries, public officials and law makers ? Ask any attorney in any county in America whether he knows of railway attorneys bribing juries, or whether it is dif-

ficult for a poor man to get a verdict against a great railway company? He will tell you that it is easier for a camel to pass through the eye of a needle than for a large railway company to win a jury verdict in any kind of a case.

If you fear large railway companies more than small ones in their power to bribe public officials, consider whether there is really any difference between the two. A large railway company has no greater inclination to bribe than a small company. The value of a local privilege which a railway company might wish to have, is no greater to a large company than to a small one. Neither does the vaster income or credit of the large company count for more than the smaller income of the smaller company. If the small company is disposed to bribe, its smaller resources yield all that is needed to satisfy the corruptible official.

When you have explored every source of your fear of large railway companies, you find at last that no greater danger is to be apprehended from a large than a small company. Each is managed by men of about the same stature, weight, ability

and sentiment, and the resources of each for the attainment of its wishes or protection of its rights are equal to the other.

A prejudice exists against railway companies under the vague impression that railway stocks are watered, and on this prejudice rests a demand that railway rates be reduced. In other words, it is said the public is forced to pay higher rates than it should, in order that dividends may be paid on watered stock. If people will take time to learn the facts bearing on this question they will see that their claim is unfounded. What are the facts? First, 70 per cent. of all American railway stocks yield no dividend whatever. Second, the remaining 30 per cent. receives less than 4 per cent. per annum. Third, a considerable part of this 4 per cent. is not earned by the company, but is paid by some other company, under contracts made years ago, when railways were few and the earnings of each railway were greater than now. Fourth, railway stocks are bought and sold hourly; in many cases the owner of to-day was not the owner of yesterday. Now, bear-

ing in mind that the only proper objects of wrath on the part of the public, in relation to watered stock, are the men who issued it—not the men who have since bought it—what conclusion can we draw from the foregoing facts? First, that as to 70 per cent. of all railway stocks there is no just cause of complaint, whether watered or not, because the public does not pay dividends on that stock; second, as to the remaining 30 per cent. on which less than 4 per cent. dividends are paid, a greater part of it is paid, not because it is earned, but because there is a contract which requires it to be paid. And, finally, there is no certainty, if railway rates should be reduced, and thereby reduce the dividend which is paid on one-third of the railway stocks from less than 4 to less than 3 or less than 2 per cent., that the blow would fall on those guilty of issuing watered stock. Therefore if the people reduce railway rates on account of watered stock, they act like a blind giant who swings a club in a crowd in his aim to strike one man by whom he has been hurt.

Certain railway stocks have been watered; other stocks are thought to be watered, but in fact are not; still other stocks are not watered, and are not supposed to be. Let the people know the situation and they will be fair.

First. When boomers build railways—not to operate, but to sell—they proceed as stated above. They give a block of stocks and bonds to themselves as pay for building a railway. The amount of these stocks and bonds has no reference to the cost of the railway. If the cost of construction and equipment, honestly incurred, exceeds the amount of stocks and bonds issued, then there is no water in either stocks or bonds. Such a mistake on the part of the boomers has never been heard of. Usually (always so far as is known) they issue stocks and bonds largely in excess of the cost of building and equipping the road. This excess is water, and dirty water too. To avoid being injured by it, the public need not rob all railway companies who have acted in good faith. They can correct the evil by changing the law, which permits anybody to build a railroad

anywhere, and make the building of a railroad a question of public necessity, to be determined by disinterested public officials. Township roads, county roads, city streets, are not opened through private property nor cast upon the public for repairs, except on petition of certain persons and their necessity approved by proper public officials. Next, before anybody is allowed to build a railway, he should file in some public department sworn estimates of its cost, and be compelled, under heavy penalties, to limit the issue of stocks and bonds to its actual cost. Under such law we would have no watered railway stock.

Second. When are railway stocks supposed to be watered, but are actually not watered? I answer, when such stocks are based on extensions and additions to an existing railway, and are paid for at cost out of earnings.

A railway is built from A to B; it has cost ten million dollars, honestly expended, for which five million in bonds and five million in stocks have been issued. No one complains of that. The railway begins operations, increasing traffic de-

mands additional tracks, lands and cars. Where shall the money be got to pay for these necessary additions? If additional bonds are offered at that early stage, they will sell at so low a figure that it is not wise to make the attempt. The stockholders, at that early period, are not disposed to subscribe additional stock and pay in more money. If they were willing so to do, the most rabid enemy of railways would not complain of it. What then is to be done? The public clamors for increased facilities. It is not wise to sell bonds at a discount; stockholders are not able or willing to make further advances of cash, but they are willing to do something else which enables the public to have the increased facilities it demands. They say to the Directors of the company, make these desired improvements and pay for them out of surplus earnings; meanwhile we will ask for no dividends. Five or ten years of this policy continues, and at the end of the period, ten additional million dollars have been expended and the railway is worth double what it was at first. The stockholders now say, we will take ten millions of stock to represent that addi-

tional value. Can stock so issued be called watered stock? Certainly not. Why? The public needed the additional facilities ; after they were made, the capacity of the road to do business and accommodate the public was doubled, and the value of the property was doubled. If stockholders had subscribed for additional shares and paid for it monthly or quarterly as the work of extension proceeded, nobody would have thought of complaining ; or, if stockholders had drawn from the company dividends, and at once turned those dividends back to the company and received stock for it, no one would have complained. What difference then, is it to the public, whether the stockholder draws dividends and converts it into stock, from time to time, or allows all surplus earnings to be applied to the work of extension and takes his share of stock for the cost of the extensions, when the same are completed.

I will admit that no additional stock should be issued to represent an increased value of the railway, caused by lapse of time or increase of business. The public has a right to share that increase

with the stockholder. The right to issue additional stock should rest on the fact of additional cash put into the property to increase its ability to serve the public. If stock issues are restricted to these limits, the people will not complain of watered stock, and they can protect themselves fully in this respect, and innocent stockholders as well, if they will, under heavy penalty, limit the issue of bonds and stock to cost of the railway and additions and to pay debts which can not otherwise be paid.

This brings us to a phase of the question not often discussed, yet important to be understood. It is clear that a sound policy requires that stock and bond issues of a railway company should be limited as far as possible to cost of the property, but experience has shown that railway companies, in spite of good management, will fall in debt. These debts must be paid in cash, stock or bonds, hence the law has permitted stock and bonds to be issued in payment of debts. Large amounts of stock have been issued in this way. A railway company becomes insolvent and is reorganized.

Its old stockholders cling to the faith that some day in the future, the stock will have value, hence they want to be represented in the new company. For a better reason, bondholders whose interest for years has not been paid, want something to represent their unpaid interest, and are entitled to a place ahead of stockholders, and they receive income bonds or preferred stock in payment of their unpaid interest. Thus a reorganized company begins its career with a large amount of stock, and the suspicion of the public is aroused against it. The cases are exceptional and should receive particular treatment. To compel all railroad companies to reduce their rates because some companies have issued fictitious stock, and others have issued stock in payment of debts, would be like putting a whole town in jail because one inhabitant was a thief. The newspaper editor, the platform lecturer, the State or National law maker, who, in general terms, denounces railway companies for issuing watered stock, is guilty of gross calumny against the railways of the United States, and does great wrong to hundreds of

thousands of innocent people. We do not denounce all editors because some are blackmailers ; we do not condemn all lecturers because a few are ignorant and rash ; we do not call all law makers criminals because some are bribe takers ; we do not say the human race are assassins because some of them are murderers. We should not charge railway companies with swindling the public because a few companies have issued fictitious stock. Let there be light on this subject, and the people will be just to railway companies.

Hostility to railway companies exists mainly because they do not give uniform rates to the public, and sometimes charge more for a short than a longer haul in the same direction. In other words, it is said they favor certain shippers at the expense of others. Railway companies derive all their powers from the public ; they are created for the purpose of serving the public, therefore it seems odious that they should give lower rates to one part of the public than to another. Laws are enacted to prevent this discrimination, and require rates to be alike to all.

The companies evade these laws by charging uniform rates and giving a portion back to favored shippers by way of rebates, drawbacks and other devices. Then other laws are enacted to prevent the companies from giving back any portion of the rate, by any kind of payment or favor, and these laws in turn are disobeyed. Every one knows this to be the situation in respect to every railway company, the result being that all companies are conspicuous, persistent, defiant law breakers. No wonder they are scourged by juries, law makers, tax commissioners and public opinion. Why then do railway companies persist in a course which makes them all criminals and brings the majority of railways to bankruptcy?

Public opinion rests on the single fact that railway companies are law breakers; no inquiry is made why railway managers break the law, or whether the law is just. Possibly an investigation will show that law makers as well as law breakers are at fault.

Although the people give corporate life and power to railway companies, they do not furnish the money to build, equip and maintain railways. This money is furnished by private individuals. A railway, therefore, is private property devoted to a public use. Nothing can be more just than that this private property devoted to a public use should be allowed to yield some profit to its owners, and at least to protect itself from insolvency. This proposition is not fully nor fairly met by the counter proposition that railway charges should be uniform to the public, unless a reasonable interpretation is given to the phrase "uniform charges." What then are the rights of the public in respect to a railway? What is meant by uniform charges? What are the rights of a railway company in respect to earning money?

Take the case of a railway, built from Chicago to the seaboard. The people of Illinois, Indiana or Michigan, Ohio, Pennsylvania or New York, and of New Jersey have united in giving corporate life and powers to this railway company. Each State expects to be benefited by the existence of

the railway. Next, there are many cities, towns and hamlets in each State, along the line of this railway. Some of these places enjoy the advantage of competing railway or lake or river service ; others have not this advantage. None of these places are exactly alike in the conditions of labor, materials, workmen or capital. The situation is further complicated by the existence of several other railways built from Chicago to New York, each on a different route, each under conditions different from either of its rivals. The laws of the different States between Chicago and the seaboard limit the rate which railway companies may charge for their services ; that is, they prescribe the maximum rate. None of these States fix a minimum rate ; the theory of the law on this point is, that railway companies might charge too high a rate if not restricted, but there is no danger of their charging too low a rate ; hence, while the law prescribes a maximum rate, it does not prescribe a minimum rate.

The omission of law to fix a minimum rate justifies the public in assuming it is at liberty to get

as low rates as it can, and justifies the companies in assuming that they may lower rates as much as they please. Thus the public gets the benefit of competition, which every one concedes it has a right to get. But railway companies naturally wish to get all they can, and never reduce the rate except under compulsion. Hence, they maintain rates where they have no competition, and lower rates where they have competition.

The right of the public to get as low rates as it can applies to every station on a railway; and inasmuch as the conditions which induce a railway company to lower its rates are not the same at all stations, it is impossible that rates should be uniform at all stations. Where competition exists, the public, in the exercise of its undoubted right, will secure lower rates than at points where there is no competition. To force a railway to make a uniform rate at all stations, would be to give to some communities advantages to which they are not entitled, and to deprive other communities of advantages they have rightfully acquired. It is not the duty, nor is it in the power of a railway

company to equalize conditions between different communities. The right of a railway company to lower its rates at competitive points is inseparable from the right of the public to get as low rates as it can. And if it be conceded that in the absence of law fixing a minimum rate which a railway may charge, the public has a right to as low rates as it can get, the conclusion is inevitable that a railway company which charges different rates at different stations is not guilty of discrimination.

This argument does not apply to different patrons at the same station. The rights of all members of the public at any given point are identical. If rates are lowered to one they should be lowered to all. Though one patron ships ten times as much at one station as another patron, the rights of the public at that station are the same, and what the railway does for one it should do for all.

This right of the public to have as low rates as it can get is the source of all complaints against railways on account of discrimination. At competitive points the railway company lowers the

rate under compulsion ; it makes the best bargain it can, and the result is all shippers are not served alike. In all these cases of so-called discrimination, whether at competitive or non-competitive points, the railway traffic manager acts precisely as the merchant and manufacturer does under like circumstances. He reduces the price to those who buy largely ; he sells at little or no profit, rather than lose a customer.

The public wishes to have as low rates as it can get ; it knows the more railways are built the lower will be the rates ; therefore it wishes as many railways as can be built. At this point the public stops wishing and thinking, and begins to smite railways because of discrimination. It fails to see that competition and discrimination are interchangeable terms. It passes laws to prevent discrimination, and with incredible folly passes other laws forbidding railway companies to do the only thing that can prevent discrimination, to wit, make arrangements between themselves to maintain uniform rates and compensate each other by division of traffic or earnings, a subject in which

the public has no conceivable interest whatever.

Why are the words "competition" and "discrimination" interchangeable terms? Competition is a condition resulting from the presence of two or more rival railway lines. Discrimination is a condition under which different individuals in the same community do not get the same rates from railway companies; neither one, two or three of the rival lines can do all the business at the competitive point; each line will and must get a share of the business. The conditions under which the various rival lines are maintained and operated are not alike in any two cases. Therefore the rates they can each afford to accept are not the same in any two cases. And inasmuch as no single company can do all the business, leaving the others to starve, a different scale of rates charged by each company is the inevitable result. Thus we find discrimination to be the inevitable concomitant of competition; for the result to the public is precisely the same, whether one railway company gives a different rate to each of its

patrons, or whether half a dozen different companies give different rates to the public. The result in either case is that all shippers at competitive points are not treated alike.

Certain railways can afford to accept a less rate than other less favored lines. The less favored lines must have a portion of the traffic, for small profit is better than none. Here begins scramble for traffic and demoralization of rates. No railway company will quietly lie down and die. Neither public opinion or penal statutes will prevent its managers from trying to get traffic and continue to do business. In this pell-mell scramble for traffic the public is robbed and the railway companies are ruined. The business of large shippers is sought after and secured at any price. Smaller shippers do not get as good rates as the larger, and the result is that small dealers are driven out of business and larger dealers increase their power and wealth. Even the large dealer is not wholly at fault in this carnival of ruin. The competition which affects the railways affects the different merchants and manufacturers. Each

must meet his rival in the field of trade on equal terms and get the lowest possible rate for transportation. Unrestrained competition crushes and grinds as remorselessly as the wheels of Jugernaut.

If railway companies were permitted to make arrangements with each other for division of traffic or earnings, the destructive results of competition could be largely obviated. Hitherto the public mind has associated such arrangements with the idea of pools and monopolies, and forbidden railway companies to make them under heavy penalties. Nine years ago Congress prohibited pooling of railway earnings or tonnage, thinking thereby to secure unrestricted competition and prevent discrimination. It did not understand that unrestricted competition meant unlimited discrimination. The country has never known such demoralization of railway rates, dissatisfaction of shippers and bankruptcy of railway companies as since the passage of the interstate commerce law.

If railway companies were permitted to make and enforce agreements among themselves rela-

tive to a division of earnings or traffic, they could secure uniformity and stability of rates, and the public would be entirely safe against exorbitant rates. Each State controls the maximum rate which a railway company may charge for the transportation of passengers and freight. That maximum rate can be lowered at the will of every Legislature. If railway companies should agree upon a rate which the public deems unreasonable, the remedy is in the hands of the Legislature to reduce the maximum. Whatever rate the law permits to be charged is presumed to be reasonable, and no harm can come to the people if railway companies are permitted to agree upon a rate which is equal to or less than the rate which the law declares reasonable. If railway earnings become too large under the operation of pooling contracts, let the maximum rate be further lowered, and railway earnings will at once diminish.

A railway pool differs from a pool of manufacturers or producers in this: The public can not control the price which private persons may charge

for what they produce, hence a pool or monopoly of producers may force prices up to an extravagant figure ; but the public does and always will control the price of transportation, and no railway company will dare to charge above the maximum rate which is fixed by law. Many people think demoralization of rates and bankruptcy of railways would cease if railway traffic managers were honest and wise. They do not understand the situation. First, while a majority of traffic managers are both honest and wise, all are not so, and one foolish, dishonest traffic manager can bring confusion to the whole situation. Second, if all were honest and wise, they could do nothing without concert of action, and this concert of action is forbidden by law. Railway companies are, therefore, by public opinion and statute law condemned to destruction and forbidden to make any effort to save themselves. The situation is precisely as it would be if a community, made up of wise and ignorant, virtuous and vicious, honest and dishonest people, were by a higher power prevented from passing laws and establishing courts for mu-

tual protection, and thus left to prey upon each other, like savages in a wilderness. Any kind of despotism is more tolerable than such a state.

It is noted with pleasure that public opinion is changing on the subject of railway pools. Those who are capable of learning facts, and can understand the truth which those facts convey, are no longer opposed to a law which will allow railway companies to make reasonable contracts with each other for division of traffic or earnings. The ignorance of law-makers on this subject has caused stupendous disaster to individual and corporate fortunes. It is hoped that the dawning of a better day is at hand.

Railway companies being created by law and regulated by law, their officers and employes are in constant touch with servants of the people who make, interpret and enforce the law. The temptation is great to give and receive money, in matters wherein the interests of the railways are in conflict with those of the public. Some railway managers are willing to pay the price, and some officials are willing to betray the public. Happily,

these are in the minority. Under our modern system of law, which forbids the granting of corporate privilege by special statute, the railway companies are seldom in legislative halls except under compulsion, to try to protect themselves against threatened injury.

There are men who make a living by work in shops, fields and mines. There are other men who make a living by working legislative bodies. They gather at the State Capitol as buzzards gather about a carcass. Usually they have served one or two terms in a Legislature, and learned in the mysteries of law making. They soon know what members are there to serve the public, and who are there to serve themselves. This is fact number one. The next factor on which they count is the fear of corporation officials that laws will be enacted increasing the burdens on corporations. The third stage is the introduction of bills to increase taxes, impose severe regulations or reduce income of corporations. This blackmailing process is aimed at all manner of corporations, railway, express, sleeping car, telegraph, insur-

ance and loan associations. Sometimes the officers of these corporations are cowards and think it necessary to pay promptly the ransom demanded by legislative brigands ; others whom long experience in the business has made familiar with these operations, pay the tribute as the easiest way out of trouble and regard the exaction as one of the elements of modern civilization ; a third class have faith in the principles of honesty, trust to the people for fair play, and by proper presentation of arguments and facts, defy the blackmailers and defeat their schemes. Corporation officials who act in this way seldom fail to protect the companies they represent to the full extent to which they are entitled to protection, but as long as some officials are willing to pay tribute, so long the system of legislative corruption continues, and all railway companies are denounced by the people as partners in the crime. The same influences, but to a very limited extent, prevail in the action of Tax Commissioners. Prosecuting attorneys, sheriffs, auditors and coroners are in position to help or hurt a railway company. Their opera-

tions are mainly characterized by a sense of justice, but often they are willing to give and receive.

In presenting these facts to the young men before me, many of whom will probably some day be called to railway service, and all of whom wish to become upright citizens, I wish to emphasize the following truths :

Railway employes are, in a certain sense, servants of the public ; the manner in which they discharge their duty has much to do with the welfare of the public. Let that duty be performed with courage, but always in the desire to do justice to the public, no less than the company they serve. When the public learns that railway officers and employes are animated by this sense of duty and of justice, prejudice against railways will disappear; the burdens which are laid upon them will be reasonable; the fetters which bind them to disaster will be removed.

II.

THE PAST, PRESENT AND FUTURE OF AMERICAN RAILWAYS.

MELVILLE E. INGALLS.

IN the year 1830 the first complete railway was put in operation. There had been many experiments leading up to this; in fact, in the world's history, all great improvements or inventions do not appear at once, but are attained by gradual steps and often appear in different places and through different persons, as though the idea had filled the air, as it were, and different people commenced to work on the same line. The world was ready at that time for something new. For the century ending with the year 1815 and the great and decisive battle of Waterloo, the civilized

world had been in a constant strife. Hardly a year had passed in which one or more of the great nations of Europe were not at war, and for much of the time all of them. The governments had been managed for the benefit of the few; the condition of the common people had been almost hopeless; every dollar that could be wrung from them by the most onerous taxation in the world had been used to build up armies and navies with which to fight. So oppressive was this system that in 1789 the French revolution broke out with its terrors. The people became like some wild animal liberated from his cage, and, knowing nothing of how to use that liberty, simply struck around in their fierce anger and destroyed whatever came in their way. Wise men, timid men, lovers of liberty, became frightened and disgusted. Reaction came, and on it Napoleon climbed to power. He soon lost his head and endeavored to rule the world, and the contest to crush him lasted for a score of years. In those years there was no opportunity for industrial improvement. No one attempted to accomplish anything except

to fight or to provide for the necessities of existence. When finally, in 1815, peace came to the civilized world, it dawned upon nations poor, weak and wounded. The condition of the poor was deplorable, and that of the rich not much better. The facilities of communication, even in countries of the highest civilization, at that time were very limited. For instance, the news of the battle of Waterloo did not reach London until three days afterwards, and it was then printed in the newspapers and sent over England in mail coaches that ran night and day, at the rate of seven or eight miles per hour.

In the few years of rest from war, between 1815 and 1830, which they had enjoyed, the people had done some work, and more thinking. In France the Bourbons with their despotic notions were driven out, and in England the people secured the "reform bill," so-called, and it was beginning to be understood all over the civilized world that governments were for the people and the divine right of kings to oppress and misgovern was disappearing. Slowly, as the nations began to recover from

their exhaustion, they devoted their time and energies to industrial improvement. The men in active life in 1815 knew nothing but war and its adjuncts. In 1830 a new generation was upon the stage, ready for another purpose. George Stephenson's railway was completed and civilization was ready to take it up and carry his ideas forward and beyond even his fondest dreams. In sixty-seven years this weakling has grown to be a giant of immense proportions, and has added vastly to the comfort and happiness of mankind. In 1830, when the first railway was opened, travel over any of the civilized countries of the world was slow and wearisome. Communities which to-day are neighbors, then knew but little of each other. England was the richest of the nations and the highest in civilization, and yet a writer at about that time, describing its internal affairs, says, "Each little community set apart from its fellows, following its own customs, cherishing its own prejudices, feeding its own traditions, speaking in a dialect which men from a distance failed to understand; a stranger was *ipso facto* an

enemy.''
In our own country at this time civilization was even more backward. The people had settled and clustered along the coast and the great lakes and rivers, but the means of communication were slow and wearisome. At this time came the railway, and its development has been one of the greatest industrial revolutions in the world's history. One writer truly says, "It has enabled men from different sections to meet freely, to learn how little there is on either side to hate and how much to love; ancient prejudices melt away by the fuller knowledge gained from travel and acquaintance; each year as men associate with each other and travel, the unity of the people becomes more and more perfect."

While railways have benefited Europe and all civilized nations they have proved more of a blessing to America on account of its great distances. American genius also seems to be peculiarly adapted to the science of transportation and railroading. We have worked out in this country the most perfect system of transportation known on earth. In England the railways have had the

benefit of unlimited capital, and in some respects may be in advance of ours. The journeys there for short distances are more comfortable, but their system, if applied to our long lines, would be an utter failure. A trip to-day from New York to Chicago is not a thing to be dreaded, but a pleasure to be anticipated. With the trains and service, you have (in the parlance of railway advertising) "all the comforts and luxuries of home." The 3,500 miles between New York and San Francisco are covered in less than five days, with ease; so that even our invalids can avail themselves of the different climates and not grow weary with the journey. The expense of a journey to-day is not one-fifth of what it was in the old days of stage-coaching, saying nothing about time and comfort. Beyond any human calculation, however, is the benefit derived from association and the facilities of communication between different sections of the same country. It has enabled the American Republic to grow beyond any thought or prediction of its founders, and has rendered distant sections homogeneous to each other which otherwise would

have been distant and unknown countries. It is hard to realize what would have happened in this country of ours if the railway systems had not been perfected. The late William F. Reynolds, of this city of Lafayette, once told me that the hardest day's work he ever did was making a trip from Lebanon to Thorntown. To-day, on trains of the Big Four, you make the journey in ten minutes.

More, however, than in the facilities of travel has been the growth of the freight traffic of the various systems. The statistics of our railways are probably known to almost every schoolboy in the land, yet it is well on an occasion like this, when we have spoken of the birth of the enterprise, to allude to and place before your eyes its present gigantic stature, so that you may have the picture more vividly before you. The latest official figures which we have are those for the year ending June 30th, 1896, and they show such marvelous proportions that I can not forbear placing them before you. The industrial enterprise that started a half century or more ago, by the aid of a few

enthusiasts who were themselves doubtful of its success, has now grown to fabulous size ; 182,776 miles of main track ; 240,000 miles of all tracks. The little locomotive that George Stephenson ran from Manchester to Liverpool is now represented in these United States by 35,950 monster machines ; 1,297,649 cars are in service ; 511,772,737 passengers were carried in the year in question ; 765,891,385 tons of freight were handled ; the number of tons of freight carried one mile was 95,328,360,278. These figures are almost beyond the conception of the human mind ; and all this freight was moved at an average charge of four-fifths of one cent per ton per mile. Think of it ! A ton of freight hauled one mile at a charge of four-fifths of a cent. The gross earnings of all the railways were \$1,150,169,376. The number of employes upon the payrolls of the companies was 826,620. If you take into consideration those not upon the payrolls but deriving their support from the railways, and consider also the manufacturers of supplies used by the railways, you will probably thribble this number. In other

words, an army of more than 2,000,000 of men are engaged in railway business, and more than 10,000,000 of our population are supported by this industry.

I have said that it cost four-fifths of a cent per ton per mile to handle this immense amount of freight, but this is the average charge. The great products of the country, like flour, corn, wheat, coal and iron, are handled for less than one-half this charge, and this low cost has enabled this country to develop its manufactories and its commerce, until it stands foremost among the civilized nations of the earth. One hundred and ninety-one million tons of coal were mined and moved by the railways in this country last year. With the close of the century we shall stand undoubtedly first in the world in the mining of coal, the production of pig iron, the manufacture of flour and the production of wheat and corn. The world stands aghast at our growth, and the great factor in such increase has been the railways. We should have had even greater development, had it not been for unfortunate legis-

lation and hostility to railway corporations, which, in the last few years, has retarded their development. The cost of all the railways in this country has been \$10,566,865,771. The net income from their operation last year, in the aggregate, was only about \$377,000,000, or about 3½ per cent. on their cost. Many of the lines paid more than this, but a vast number nothing; in fact, about one-fifth of all the railway mileage of the country last year was in bankruptcy, and managed by receivers appointed by the courts. Legislatures, National and State, and city governments—nearly everywhere, seem to be hostile to these great enterprises.

I propose in the time I have here to give, briefly, a history of the causes which in my judgment have led up to this hostility and what is necessary to be done to change it. In the beginning of railway development capital was scarce and but few people were willing to invest in such a hazardous business, and the need of the communities was so great that any extraordinary concession asked for was quickly given. Even then, the first pro-

motors lost nearly all of their investment. But few of the great trunk lines which were constructed previous to 1855 were enabled to go through the panic of 1857 without bankruptcy; stocks of some of the best roads in the land, and which to-day are paying large dividends, went down to five and ten cents on the dollar, and many of them were entirely wiped out by foreclosure proceedings. With the close of the war in 1865 a new and enormous development commenced in railway building, and there came to the front then a practically new class of business men known as railway promoters. It was no unusual thing for these men to take contracts for building hundreds or even thousands of miles of railway. Their plan was to procure the most favorable charters from the States or the Government, to obtain large concessions in lands along the line, then organize a company, issue as many bonds per mile and as much stock as they thought the public would take, obtain from cities and towns as large subsidies as possible in money and promises; then make contracts with themselves

by which they received all the lands, subsidies, bonds and stock, for constructing the railway. They constructed it as cheaply as possible ; they sold the lands for the best price obtainable ; sold the bonds and stocks to the public ; and then marched on to take other contracts and conquer other lands. When the day of reckoning came, as it was bound to, the public found themselves the owners of bonds upon which the interest could not be paid ; the communities found themselves with a poor railway in which they had no direct pecuniary interest ; they saw the contractors with enormous fortunes, and they concluded that they had been cheated and robbed. Hence, through their Legislatures and city and town governments, they began to get back at the railways by imposing onerous taxes and obligations and by attempting to fix rates of fare and freight by legislation. This was the start of the so-called “Granger legislation” in the 70’s. This legislation went through the various States and finally, in 1886, Congress passed the Interstate Commerce Law, and since that year the difficulties have been more with

reference to that law than with State laws. That law practically prohibited contracts among railways for the maintenance of tariffs; or, to be exact, it prohibited pooling, which is an agreement between two or more competing lines to divide the business in certain proportions; it being the judgment of railway managers then, and to-day, that in no other way can permanent and fair rates be obtained except by such division of business. Two individuals in trade can quarrel and sell goods below cost, and one of them soon becomes bankrupt and the other then employs him and holds all the business; but railways being public corporations continue to exist, and when they fail are managed by a receiver and become worse competitors than ever. It is said that the public get the benefit of this competition, but only a certain portion of the public. The large shippers are able to take advantage of this condition of affairs and make their contracts, avoiding the law through one way or another, and then they can undersell the small shipper and drive him out of business, and the result for the

last five years can be seen all over this country in the disappearance of the small shipper, the small manufacturer, and the growth of the larger. This is also true of communities ; the effect of the Interstate Commerce Law has been to build up places like Chicago and break down places like LaFayette. The condition of affairs apparently culminated last spring in the decision of the Supreme Court of the United States in what was known as the "Trans-Missouri" case, in which that court held that the Sherman Anti-Trust Law applied to railways, and therefore practically any association or agreement was illegal, and since then the railways have been in a chaotic state, rates irregular, the earnings diminishing, and their patrons, the public, suffer ; investors have become frightened, foreigners have sent home and sold our bonds and stocks ; and out of these troubled times has grown the business of reorganizing railways, until nearly one-third of the mileage of the country has been sold under the hammer and reorganized. The old stockholders have lost their investment or else have secured a new interest by

paying large assessments. In addition to this, the different States and cities and counties have inaugurated a system of taxation by which all bonds and stocks of railway companies have been subject to listing and taxation, although the corporation paid the taxes upon the property itself. That is, a party in Indiana owning bonds or stocks in a railway is compelled to list them and pay taxes upon them, while if he lived in New York he would not. You can see at once that the Indiana man will sell his securities to the New York man, for, while the rate of taxation may be light, it is enough to change the investment. The result has been that the local communities have sold their bonds and stock; the investments have drifted to Wall Street, and the bonds and shares of our principal railways are to-day used simply as counters are used in a game of cards, to mark the speculative gains or losses of the holders. This is the most unhealthy condition to which a great business enterprise can arrive, and we must bear in mind in considering this question that there is no one business that involves so much the pros-

perity and happiness of the people as that of the railways; the entire community uses them. The railways of this country, as heretofore stated, employ nearly a million of men in their operation. There are more employed directly in the manufacture of supplies which are used by the railways, and this army of men, with the families dependent upon them, constitute about one-fifth of our population, all of whom are dependent upon the railways. The prosperity of the railways is their prosperity; the loss of the railways is their loss. There can be no prosperous times in this country unless the railways prosper. No body politic can be healthy when one-fourth or one-fifth of it is diseased.

What is the future? There must be changes in legislation and in the management of railways. Some plan must be adopted to increase the ownership in railways by parties residing along their lines. The first great step towards doing this must be a reform in the tax laws, so that citizens of Indiana or other States can be put upon as favorable terms for ownership of bonds and stock in a rail-

way as citizens of New York. Greater permanence must be given to the condition and ownership of railways. It would be a great step if we could adopt the English method and create debentures instead of bonds; or, in other words, provide that there should be no foreclosure for non-payment of interest. Such a thing as foreclosure of a railway in England is unknown. If the interest is not paid upon the debentures, there may be a receiver of the profits, but the stockholder still holds his interest in the property. Here, with our system of bonds, if there come a few bad years, when the interest is defaulted, the bondholder takes possession and sells it under his mortgage, the interest of the stockholder is extinguished, and when prosperity returns he has lost his opportunity to get his share of it. This makes the possession of railway stocks speculative and uncertain; in fact, for years they have been more subject to assessments than to the receipt of dividends. If our form of mortgage could be changed to that of the English debenture, it would stop the immense number of reorganizations, and would

prevent values being wiped out in times of panic, and would encourage investment by the people in the securities of these enterprises—for, after all, that is the real improvement that is to come. The New England railways have less trouble with Legislatures and courts, chiefly because they have a great many small holders of stocks along their lines and in the cities, each of whom is an agent of the corporation and aids in creating public sentiment and procuring fair treatment, while in the great Central States and in the West there are scarcely stockholders enough to provide the officers for a stockholders' meeting. The railway officials themselves must be taught to conduct their business with care and with due respect to the rights of the people. Their actions must not be secret, but above board and open to the public. There must be but one rate to everybody, and that must be reasonable, and the Legislatures must provide remedies by which railway officials can agree with each other on these rates and their contracts can be enforced. The present State and national laws in reference to railways are crude and crazy-

patch works, passed in some cases out of revenge for wrongs, real or fancied, and in others for political effect, and all in opposition to the railways. Unfortunately, railway officials have opposed all legislation that looked to the control of their powers, and have not tried to direct and perfect the laws as they might have done. There should be clear and positive legislation authorizing railways to contract with each other for the maintenance of tariffs and the division of business, and it should be made the duty of the Government Commissioners, and they should have the power in such cases to see that rates are reasonable, and their decisions as to whether reasonable or not should govern, subject to appeal to the courts.

The improvement of the country demands that the great articles of export, like cotton, wheat, flour, corn and meats, should be carried at the lowest possible rates. The railways should pattern after the English system, and while making extraordinarily low rates for these great articles, should exact a terminal upon the higher classes of freight and upon freight carried short distances, so

as to provide interest upon the immense terminals they have to have. In other words, while a railway from Chicago to New York may possibly haul corn for fifteen cents per hundred pounds without loss, it could not haul it for 100 miles on anything like a proportion of this rate without great loss. The same is true of many articles that enter into railway traffic. Therefore, in order that the country may be benefited by having its great articles of export and of manufacture carried cheaply, there should be a terminal charge affixed to other traffic which would enable the stockholders to receive something for the very large investment they have to make in every city and town for facilities wherewith to do their business.

Passenger rates are made entirely upon the wrong basis. We charge the same for the man who rides in the palace car, and for whom the railway has to haul two tons of dead weight, as we do for the man who rides in the ordinary coach, and for whom only one-half a ton of dead weight is hauled. We charge practically the same for the passenger who is carried sixty miles

an hour on the fast and expensive train as we do for the passenger upon the slow and less expensive train. These rates should be changed and graded.

Above all, a better understanding must be arrived at with the vast army of employes. They must have greater interest in the success of the railways, and they must be a part of the power that will produce a better understanding with the communities which the railways serve. This must be done by a system of hospitals, pensions and profit-sharing.

Probably locomotives propelled by electricity will come in the future. If not, something else may. And we can not tell what the next years have in store in the way of improving our railway facilities. Higher speed, possibly cheaper trains, but it is necessary to this country of ours that the railways should be encouraged, so that they may go on improving their systems, so that branch lines can be built to every county seat in the country. Instead of stopping at 182,000 miles of railway we should build at least five thousand miles a year in

short and inexpensive lines as feeders to the main systems, so that the days of the stage coach and the heavy wagons should be unknown. This country will soon have one hundred millions of people. It will require at least 250,000 miles of railways to serve them properly—an increase of 40 per cent. over the present mileage. They can not be built, they can not be improved and increased, with the present system of legislation, and with the present prejudice against them. The development of the country demands that this must be changed. It is through such institutions as this, it is through such students as these, that the change must come. In the centuries that have gone, the youth of the various countries sought fame and preferment in war and its accompaniments. We live in better days and in a higher civilization, but the service of our railways offers a wider field for advancement, and for fame, than anything of old. The road to success in this line is not through carnage and suffering, but it is none the less sure and requires equally moral courage and intelligence. A new evangel must

be preached in reference to railways; they must be placed upon a higher order, and instead of being pariahs in business, they must be the benefactors and friends of all.

I want to add just one word with reference to Purdue. I had no idea, until I came here to-day, that it was so great an institution as it is. I had learned to respect your President. I had known what hard work he did, and I thought he was building up something here, but I had no notion whatever that he had accomplished so much or raised such a foundation as he has. I congratulate you that your lines are laid in such pleasant places. You can learn here what it takes years and years of hard work to learn practically if you are going to learn it at the bench, or firing an engine or at work on the railway. The great English world, the great end, is to get rid of what I call the dollar-a-day man, or the man who does the drudgery, and who never gets above it. This college of yours enables you to start above that, and all you have to do is to improve your opportunities and the fortunes of the world are within

your grasp. As I went through these halls to-day it carried me back to the times when I was a student and a teacher, and I could not help thinking how many more privileges you have than we had years ago, and what a glorious opportunity you have here to learn something practical and practicable, so that when you go out from these halls, instead of going to the drudgery of what I call a dollar-a-day man, you can start on a higher basis, where you can do credit to yourselves and to your university.

III.

THE MUTUAL OBLIGATIONS OF RAILROAD CORPORATIONS AND THE PUBLIC.

JOHN W. NOBLE.

YOUR attention is invited to-day to a consideration of the mutual obligations of railroad corporations and the people, because we all more frequently hear of the rights claimed by others than their corresponding duties—and it may not be unprofitable to take a short survey of both.

Your studies have already led you to investigate the natural laws applicable to railroad building. A knowledge of the laws of matter is essential to this construction and the mechanical operation of the road requires their application with the

nicest precision. Experience has as yet discovered but a portion of these laws, but wherever known they are recognized to be supreme. They are immutable. The structures of antiquity that have come down to our own times are maintained on the same principles of natural philosophy as the most recent product or engineering skill. Where these are obeyed there is harmony and strength, but for their violation the penalty is failure and ruin.

But how different is it as to human institutions, Reared under laws themselves imperfect, they vary as time or locality seems to demand, and in the same nation they change as man's intelligence advances or retrogrades. The corporation is no exception to this observation. When man comes to deal with this legal creation, by whose instrumentality the railway is formed and operated, he feels no compulsion to obey the laws of the State regarding it. He rather strives to test its authority, its claim to any right to continue or exist; and with a desire to have its benefits yet enjoyed, deems it a hardship that corresponding burdens

are imposed. The railroad manager is restless under the interference of the State and the decisions of the courts, and the people while transported by the road would be delighted, apparently, to have the corporation demolished. While they would declare the engineer insane, who having wrought some great and beautiful work should at once overweight it to its crashing fall, or the community demented that should insist upon removing the buttresses and stays of the bridge, and expect it to stand, yet when the railroad company begins its career, it is often, not to say generally, deemed as intended merely for private pecuniary gain, or on the other hand, it becomes an object of individual prejudice or public jealousy, although created by, for and under the immediate control of the people and the State.

We may depend upon it, however, that as there is a law that knits rock to rock and holds bar to bar, or drives the piston or flashes the subtle electric fluid, so that the tower stands, the bridge remains fixed across the flood, and the train reaches its destination on time, so there are laws

that as they allow the creation of corporations will sustain them in so far as those laws of their being are acknowledged or punish when they are broken, and will wrest the advantages they bestow from a people that for long does them injustice. The created can not sanely hope to control the creator, and it is madness on the other hand to create only to dwarf or destroy. Nevertheless we are all aware that we are amidst a social and political conflict arising from the discontent of a large portion of our people that deems there is an unauthorized accumulation of wealth in the hands of corporations, and a consequent power with increasing disregard of obligation to the State, and an opposing activity on the part of these bodies to maintain their privileges and protect their property against, as they deem, assaults unwarranted by the law and revolutionary in their tendency. This discontent, working to adjust affairs to new conditions, has brought up for discussion many most important questions affecting our present political and social situation and our future national well-being. To the solution of

these public attention can not be too often drawn, for it can not be denied that the best informed do not feel masters of the subject nor able to form conclusions on which they may confidently rely. It certainly is not assumed by the speaker that he can do so. If, however, by a few reflections, he can help to a just estimate of the mutual obligations of railroad corporations and the people his task will not have been undertaken, it is hoped, in vain.

You will of course understand the subject must be dealt with for the most part in outlines and reliance placed more upon suggestion than demonstration on every point, and as we proceed it is hoped you will not, before we are through, attribute what is said at any part of the discussion to a partisan spirit, for the personal interest the speaker has is that of neither a corporation official nor a communist, an anarchist nor a bondholder, but only that of a citizen who, like you all, seeks to understand the signs of the times and to advance the public welfare.

It seems essential to this discussion to recur to some first principles at the risk of being thought to state much that is trite. But as our object is ultimately to deal with obligations it is necessary to bring before us the privileges and benefits enjoyed, all of which have their source in established law and constitutional government.

Let us then first consider the corporation, and particularly the railroad corporation, and what the State has made it, upon what consideration this has been done, and whether it is claiming more than is warranted it, and whether there is any reason for jealousy of, or discontent with, its action. And, on the other hand, what benefits the people have derived or wrongs suffered from the railroad corporation, and whether there are any substantial grounds to fear legal obligations will not be observed, and how, in either case, if abuses exist or dangers threaten, the remedy is to be applied.

What, then, let us recall, are some of the grants the State through its Legislature conveys and of the privileges it has through its courts bestowed upon these bodies; for it is true that to the fran

chises originally granted to the corporation by statute the courts of the United States have superimposed other attributes which have led to most important results, and, among others, placed the decision of corporate rights and obligations largely in the courts of the United States as distinguished from the courts of the several States.

The growing spirit of antagonism to which we have referred is marked in its disposition to find fault with established definitions, and men of but slight experience do not hesitate to challenge the expositions given us by Chief Justice Marshall, Justice Story, Daniel Webster, and other eminent founders of our institutions, and plunging headlong against these tempest-worn but yet unshaken buttresses of constitutional law. Definitions, legal procedure, and constitutional guarantees are questioned because they are fixed and will not give way to the theories of late indulged in. The arrayed forces seem to feel they could manage better with less law and cut a larger figure in affairs if the fatherly State would let them alone. But let us remember that these very forms were made to

meet just the condition we find at hand—a passionate and unreasoning, if not uninformed, spirit of change; and that the fundamental principles of our Government and the rules for its due administration have been written so as to be read of all men in lines as if engraven on stone and of authority derived from the experience of our race.

We may then, it is submitted, be old-fashioned without being deemed entirely out of fashion, and quote, as has been done for so many years, the words of Chief Justice Marshall:

The corporation is “the mere creature of law; it possesses only those properties which the charter of its creation confers upon it, either expressly, or as incidental to its very existence. These are such as are supposed best calculated to effect the object for which it was created. Among the most important are immortality, and, if the expression may be allowed, individuality; properties by which a perpetual succession of many persons are considered as the same and may act as a single individual. They enable a corporation to manage its own affairs, and to hold property, without the

perplexing intricacies, the hazardous and endless necessity of perpetual conveyances for the purpose of transmitting it from hand to hand. It is chiefly for the purpose of clothing bodies of men, in succession, with these qualities and capacities, that corporations were invented and are in use. By this means, a perpetual succession of individuals are capable of acting for the promotion of the particular object like one immortal being.” *

Were the attributes mentioned by the Chief Justice the only, as they were the most general and prominent ones, with which the corporation is clothed, they were enough to have led to its rapid adoption in our country for the transaction of business affairs and the control of property. It was already in the days of Marshall a rapidly developing result from the advancing spirit of the age and of our republican institutions that commerce and all great ventures and enterprises should be undertaken by associated action. The corporation was itself similar to a republic in form. Its shareholders were its constituents, its directors

* *Dartmouth College v. Woodward*, 4 Wheaton, 636.

its legislative body, and its purposes executed through its president or other chief officers. It was not dissolved by the death of any of its members like a copartnership, and it brought together the means of many to form a capital, and while those contributing were relieved from the immediate care of the business, they shared in the profits. The American was not slow to recognize it as a most desirable business form and one akin to this new republic. Indeed, President Elliott, in his book, "*American Contributions to Civilization*," affirms the corporation is an agency for training masses of people to the high virtues of fidelity and loyalty, and though no longer an exclusively democratic agency it has given strong support to democratic institutions.

But in the case from which the definition stated has been quoted, there was declared a new, additional and most important principle applicable to the relation of these bodies to the State; and that was that in granting a charter the State made a contract with the corporation, the obligation of which could not be afterwards impaired by the

State, under the inhibition of the Constitution of the United States. This decision was made in 1819. Many corporations then existed indeed, but they were few in number and feeble in power compared with those that soon thereafter began to form in all the States for business purposes, and that movement was impelled, no doubt, in part, by the great additional security given by the decision just mentioned. Justice Story, at the period stated, to illustrate the difference between a public and a private corporation, could cite as examples of those whose objects and operations partook of a public nature, only banks, insurance, canal, bridge and turnpike companies. It was but comparatively a short period, however, before not only the corporations greatly increased in numbers, but the railroad company appeared. But from the beginning there was a spirit of jealousy toward all these organizations and of criticism of their influence prevalent. A signal instance of this opposition appeared in the case of Bank of Augusta against Earle, decided in the Supreme Court of the United States, about

twenty years after the Dartmouth case, in which the question was whether a corporation could make a valid contract beyond the confines of the State in which the corporation was created. Counsel of eminence argued this question not only with learning and all the logic at their command, but with very considerable personal feeling and the court decided it with great consideration. It was a question that, judging from his laborious and earnest argument before the court, gave to Daniel Webster, as a statesman and a patriot, great uneasiness.

Mr. Ingersoll, voicing the feeling and judgment of many, said :

“ At the period of our independence, there were few, if any, corporations, and no banking corporations in America. * * * Not until long after the American Revolution had the corporation begun to germinate, and only within a very few years last past has it attained a growth which overshadows all our institutions. Philosophical guards of this formidable *imperium in imperio* can not be dispensed with without enabling a vast

engine of factitious wealth to crush communities."

On the other hand, Mr. Ogden, one of the counsel, argued, that:

"One of the most important objects and interests for the preservation of the Union is the establishment of railroads, and they could not get on without the power to make contracts, such as were then in question."

These references and quotations show the advance of the corporation in those few years into the broad fields of insurance, manufacturing and transportation, and illustrate how the courts were adapting the powers of corporations, as they existed at common law, to the peculiar relations between the National Government and those of the several States. And we are able to perceive how the genius of our statesmen had to emancipate itself from the strict construction of former legal relations to give free scope to our institutions. Mr. Webster himself remarked, "We have no second LaPlace, and we never shall have, with his *Mechanique politique*, able to define and de-

scribe the order of each sphere in our political system, with mathematical precision. There is no such thing as arranging these governments of ours by the laws of gravitation, so that they will be sure to go on forever without impinging." There had to be adaptation of means to the new and then experimental form of our government, and our country was indeed fortunate to have had statesmen then who were equal to the task. We need such men now. The field is open, my young friends, and you need not hesitate to enter. You will not only have to enter, but to act.

Let us next note how corporations were authorized to sue or be sued in the United States, for from this much of importance has resulted. At the period of the Augusta Bank decision it was accepted doctrine of the United States Supreme Court, that under that clause of the Constitution giving to United States Courts jurisdiction in suits between citizens of different States, a corporation could there sue, or be sued, only when all its members (or stockholders) were actually citizens of the State where the corporation was created.

It could not be affirmed broadly that a corporation was a citizen, and the question was then, how could it sue, or be sued, in a United States Court?

The Supreme Court first held that the artificial being—the mere legal entity a corporation aggregate—was not a citizen, and could not sue or be sued in the courts of the United States unless the rights of the members in this respect could be exercised in their corporate name. Subsequently it announced that a corporation created by and doing business in a particular State was to be deemed, to all intents and purposes, as a person, although an artificial person, an inhabitant of the same State, for the purposes of its corporation, capable of being treated as a citizen of that State as much as a natural person; and especially in the manner in which it can sue and be sued, it was substantially, within the meaning of the law, a citizen of the State which created it. These propositions are very familiar to us now, but they were in those days by no means self-evident nor acknowledged by many; and had those presiding in our courts not been statesmen, as well as learned

Judges, the corporation of to-day would have been for original jurisdiction in the hands of the State courts. Shortly afterwards the courts rather inveighed against the opinion that the corporation should not be deemed entitled to sue in the national courts, or that other suitors should be compelled to sue the corporation in the State courts, where, it was said, the suitor must contend with powerful corporations in local courts, and where the chances of impartial justice would be greatly against him, and where no prudent man would engage with such an antagonist if he could help it. And it was decided that members of the corporate body must be presumed to be citizens of the State in which the corporation was domiciled, and that both parties were estopped from denying it, and this proposition was finally affirmed and is yet the law. Thus we perceive that, in addition to the ordinary powers possessed by corporations, they have been, against the most earnest opposition, declared by the courts to hold charters that are contracts with the States that can not be constitutionally impaired by statute or decision ; that they

can make contracts beyond the limits of the States where they are created, unless there is express prohibition by law of the State where the contract is attempted to be made, and that then bodies may sue or be sued in the United States courts as if citizens of States, without inquiry into the question of the citizenship of the individuals composing them. You will notice, running like a golden thread through the expressions of the courts, that these bodies, and particularly the railroads, should be thus endowed in support of the union of these States ; and so that the political system then new in operation should not, by too technical decisions of the national tribunals, become an instrument of injustice, and thus fail of the purpose for which it was created. Corporations thus became, in a sense, nationalized. And it is further to be noted that in their opinions rendered and their conclusions reached in days so long ago the particular questions now agitated between capital and labor were not in view any more than railroads were when the court was illustrating the subject before it by reference to canals and turnpikes. There

was indeed great political agitation as to the banks, and especially the United States Bank, and political parties were fierce in their support or opposition to these particular institutions ; but the questions to-day so prominent were not up, nor were the decisions named made in view of them. We have now come upon new questions indeed, but the lessons of the past give us reason to believe that they are not beyond adjustment if we adhere to reason and have the wisdom the fathers had.

Corporations are not in our times usually given perpetual succession, or “immortality,” as it was termed by the Chief Justice, but only a continual existence for a number of years. They do enjoy, however, under the decisions of the Court, individuality. Their legal entity is not only equivalent in the law to that of persons for the purpose of their creation, but there are added thereto many advantages in the way of franchises that individuals do not possess. And the corporation itself, by almost universal rule, now has itself also the right to mortgage or otherwise encumber and so, if necessary, dispose of all its franchises,

other than that to be a corporation. And when we speak of those engaged in what is deemed public business, and particularly railroad companies, there is added the further and most important right of *eminent domain*; the power to take private property for corporate use, without the owner's consent, and indeed because he will not consent to voluntarily dispose of it upon an offer of an alleged fair remuneration. It matters not how dear from the associations of his life the property thus sought may be to the owner; how much adorned; by what labor and care of years preserved for a home; or valuable to himself for his own business purposes, the State confers upon the public corporation so much of its sovereign power as will enable it to appropriate upon just compensation, the real estate necessary to its own use. And we may lastly observe that the State declares the roads and bridges thus established are public highways, but with the right of the corporations to demand toll for transporting thereon freight and passengers; and while the theory may exist that others could also use these

roads, being public highways, yet in practical effect there is given to the particular bodies constructing and owning them, the exclusive possession and use. These highways, moreover, when extended from State to State have a business that because it is between the several States or foreign nations, secures it the protection of the national government, which has the exclusive power to regulate interstate commerce and the property of such corporations is protected by the same power in case of assault under the forms of law or incidentally.

This short synopsis of the privileges conferred brings into view the peculiar and valuable rights and privileges conferred on these bodies by the State. Multiply these considerations by the number of these bodies already existing, extending through all our States and territories, authorized by the State and by the Government of the United States, uniting so as to form continuous lines of transportation, some crossing the continent and many projecting through many States, and the privileges conferred may be appreciated by meas-

uring the obvious power bestowed. Our railroads have about two hundred thousand miles of track and transport annually nearly 800,000,000 tons of freight and more than 500,000,000 passengers ; they are served by nearly a million employes, and their liabilities in stock and funded debt amount, apparently, to over nine thousand million dollars of capital ; while statistics indeed fail to adequately present the vast amount of property, business and employment held, whether in great combinations or in ordinary business possession, by other corporate bodies engaged in pursuits of almost endless variety, banking, insurance, real estate, mining, river or canal transportation, manufacturing, trading in wares of every kind, and so on as to every human occupation.

Whether we contemplate the benefit to the real owners of a single corporation or the general benefit enjoyed by the great mass of these bodies, the advantages bestowed are of a nature and extent that no one can pretend do not carry with them great corresponding obligations. And this brings us to present the consideration for which

these rights and privileges and favors have been bestowed. This, like so many of the great principles on which our Government laws rest, was declared by Chief Justice Marshall. He said:

“The objects for which a corporation is created are universally such as the Government wishes to promote. They are deemed beneficial to the country; and this benefit constitutes the consideration, and in most cases the sole consideration, of the grant.”

This legal proposition does not mean that any and every mere material development of its resources or accommodation to its inhabitants is the sole benefit the country is entitled to receive from the public corporation to which the State grants existence and power. It means all this indeed, but it means also that in the exercises of its franchises the corporation shall primarily regard and promote the public welfare as the sole consideration upon which it can claim to continue its career or existence. “The act of incorporation is for the benefit of the unincorporated as much as for the incorporated.”

If the charter is a contract, it must be supported by a consideration moving each party to make it, and that to the State is the promotion of the public welfare. If it can make contracts beyond the limits of the State where created it rests not alone upon comity, but upon the claim it has to the privileges and immunities in other States it enjoys when created, and subject to the obligation to support elsewhere, as at home, the public welfare; if it may sue or be sued in the United States Courts it is because the national government has extended to it the protection of its forum for the promotion of justice and the protection of the vast material interests within corporate control, and that it has been deemed from the earliest days of our national existence, could not be safely left to the State courts and juries. And if the sovereign right of eminent domain has been bestowed upon them, it has been because individual interests of the most sacred proprietary character have been deemed insignificant in comparison with the public good these bodies are expected to secure and the public welfare they

have promised to support. Under other forms of government no titled personages, or private subjects have ever been so highly favored. The grants to Lord Baltimore or William Penn, though munificent, sink into insignificance with those rights and privileges given to such a corporation as the Union Pacific Railroad Company, and in the aggregate enjoyed by the hundreds of railroad corporations in the United States, either singly or in combination with each other. In either case there was undoubtedly in contemplation by the State the development of the natural resources of the country, the population of new territory, and thus to increase the strength of the sovereign government. But there was then, as there is now, with the grant the underlying and imperative duty imposed of loyalty to the State, fidelity to the interests of its people, and justice with unquestionable integrity in all business relations.

Hence we may say that the first great obligation of all corporations, and particularly of all public corporations, such as railroad companies, is scrupulous fidelity to their public trust.

It will not be here claimed, of course, that those seeking the grant of the privileges conferred, may not be properly moved by the purpose of making a personal pecuniary profit thereby, but this must be, necessarily, in view of the grants they secure, subordinate to the interest of the State and with a view to advance the public welfare.

Creatures of the law's creation, they do not, and should not, attempt to make, control or evade the law, but, from the very source of their origin, should be the most of all obedient thereto and the supporters, without guile or undue influence, of a just administration of the government, and sincerely regardful of the enjoyment by others of their rights and privileges as inhabitants and citizens.

This seems a plain proposition and worthy of all acceptation. That it is present as an influence, either in the minds of those who operate these corporations, or even of others who have to deal with them and fear their power, may well be denied. The possessors of the privileges conferred strive to make the greatest profit they can, and

leave it to others to look out for themselves, and the citizen rather considers the personal disadvantage he may suffer or fear. But neither the one nor the other thinks of the source of the existence of the grant or the superior obligation because thereof, resting on the creature to obey the law of its creator, that the public interests may be served.

Let it not be supposed that these remarks are made from any want of appreciation of the great and manifold benefits derived by the people from their existence and operation, of railroads. The speaker needs not go to history to learn the changes for the better brought about by these bodies. It is within the lifetime of many now living that the first were constructed in our Western States. The time can yet be well remembered when our legislators, dispersing at the end of a session, went to their homes by the turnpike, or by the dirt roads radiating from the capital. The vehicle of the traveler or of the common carrier was the old stage coach, while the mail was carried on the horse in the days of Cowper by the

postman with spattered boots and frozen locks. No railroads existed to any considerable extent throughout the middle States and none at all in the great west. Manufacturing, to the small extent carried on, and merchandizing were altogether in the hands of individuals. Good roads, so essential to the development of a country, to its advance in intelligence, comfort and civilization, were wanting. With a foresight and patriotism that marked him the greatest statesman and endeared him then to his fellow citizens, as it does his memory now to his countrymen, Henry Clay strove not unsuccessfully for internal improvements, and had brought into existence the great National Road running to the west; but with all his genius he had not conceived, as no man could, the wonderful development by railroads that have since transformed the country. He had advocated a public policy which he believed would develop manufactures in the United States, but he did not, as no man could, conceive of the awakening of that spirit of invention that has united the people of all our States

by the power of instant communication of intelligence, the rapid dissemination of printed or written information and the transportation of freight and persons over mountains and plains, from one confine to another with a celerity and precision, then inconceivable. He, however, had a sublime faith in the people, a love of our country, and he knew that its commerce beneath the State would arise to gigantic force and in time occupy by some means all the wide area of our land, and hold by its unyielding grasp the Union together. The railroad corporations have been that means in large part. They have spanned the continent. They have united every hamlet, not only with the capitals of the States, but with the national capital. The people and the United States government having removed the savage tribes and cleared the way for them, and paid to build them in great part, they have, in conjunction with other corporations, supplying them improvements and assistance in various forms, made a journey from San Francisco to New York a pleasant jaunt of a few days. They have made it possible for

the merchant in most distant parts to visit easily any metropolis to purchase and again to sell through a wide expanse of territory, and to communities before inaccessible. They have produced incomes which great multitudes of our people have enjoyed, and they have employed masses of men with labor more or less requited. They have transported our mails and carried our troops, and upon due compensation performed many of their public duties. More might be said in this regard, but you have probably been told of these things by others who have preceded me. Many persons seem to think the railroad corporations have made our country, but the truth is our country and our people have made, not only the railroads, but the corporations that have solicited the franchise to manage them for the States' purposes. Enough has been expressed to remove the thought that what has been done by them has not been valuable and of great benefit and is duly appreciated.

But to have done well in some, or even many and very important particulars, is but a return in

part to the State of the great consideration due for the privileges conferred. The full measure of that return requires there should have been no delinquencies affecting the public welfare, and certainly no complaint made if such be pointed out and reformation suggested.

Without endeavoring on this occasion to enter upon an exhaustive statement of the delinquencies of corporations in their relations to the public, but rather to illustrate by a few examples, the subject we are considering, and not attributing the misconduct of their affairs by any means to all such bodies, one—as time presses—may be prominently mentioned as a gross violation of corporate obligation and that which has been the least controlled by statute or court decision. This is the creation of bonded indebtedness far beyond the actual value of the property represented and on which, by mortgage or other form of lien, such liability is professed to be secured. Whatever effort has been made by the State to restrain this evil, has been either too feeble to be effective, or too vague to be enforced; and while there have

been many foreclosures and sales of property, there have been few or no proceedings by the State to enforce such restriction as may have been enacted, by forfeiture of the franchises enjoyed or the punishment of those officers perpetrating the wrong, as there should have been.

The aggregate amount of bonded indebtedness of the railroad companies of the United States over and above any fair or even liberal valuation of their property is not only in itself immense, but the reckless disregard of the first principles of fair dealing in such matters has been shown in our courts of justice for many years past and is daily developing. On the 180,000 miles of road equipped the funded debt is over five billion dollars; and the capital stock is about as much more. This little corporate republic has not, in every instance, been worthy of its parent in integrity, nor inherited that regard for the rights of others its extraction would lead us to expect. A property, whether of ordinary or of very great value, either in possession or in expectation of acquisition by the company, is first represented by a capital

stock that were there to be no immediate encumbrances whatever on the assets, would be deemed largely fictitious. Every corporation is debtor to its capital, and its possessions should be sufficient in actual value to meet this liability. It is indeed true that these assets need not be real property or other tangible things, but may consist in those very franchises the State has conferred, or the benefits derivable from the use of the other property singly or in connection with other like possessions. "The capital stock of a corporation and the shares in a joint stock company represent not only the tangible property, but also the intangible, including therein the corporate franchises and all contracts, privileges and good will of the concern." But with every allowance for the intangible with the tangible, the excessive capitalization of very many companies, is not only obvious on the most cursory examination of their condition, but is exhibited in the prices of the stock in the exchanges of the country, ranging at a few cents on its par value. It makes its first appearance on the lists dwarfed and discredited.

To this liability there is added, not only the bonds issued for the construction of the company, as a first mortgage, and which itself demonstrates that the stock has not been issued for any pecuniary equivalent to the company, which otherwise would be sufficient in itself to have built the road, but the first encumbrance is followed in time by another and that by another and so on, until the blanket mortgage is created whose value is but small and whose purpose and early effect is to put the property into the hands of a receiver, to effect a sale; and through a syndicate of a portion of the holders of these last bonds obtain the possession of the effects and franchises of the old company and create a new one free from the old and unsecured legal liabilities and frequently with a scaling of the prior mortgages. Were there no other evil than such willful and unprincipled disruption of the system intended by the State and covenanted to the State to be perpetuated for the term of the corporate existence, it would be such a violation of the obligation of the corporation to the people, as is unpardonable.

But it, in most cases, inflicts much greater wrong. For in the case of a railroad very often many bonded obligations of other and dependent roads are thus almost absolutely destroyed. These are those obligations secured on branch roads or leased lines built by small and separate corporations which alone are legally and primarily liable on the bonds, and whose roads would not be deemed at all a sufficient security but for the connection with the greater company, which takes the leases and promises or guarantees the payment of a sufficient rent to pay the interest on the branch mortgages as it accrues. But this promise or guaranty is not itself secured by the main company by lien on any of its own property, and stands on the footing of a merely general obligation, and is made before the blanket incumbrance. And so it results that on the foreclosure on the main or lessee's road, and the utter bankruptcy of the older company and its disappearance from the field of operation, the holders of the bonds on the leased lines are thrown back on to their original and insufficient security and nec-

essarily suffer an immense loss of the principal invested, with all the intermediate loss of income and in many cases with great individual suffering. For these bonds have been made to sell, and by adroit means are put into the hands of small holders, men, women, trustees for minors and of various charitable and educational institutions, which have, with no sufficient understanding of the insecurity of the guaranty, been misled and seduced by the temporary good reputation of the main company.

This is not an illustration taken from a single instance, but is drawn from many and notorious instances of railroad management, and is mentioned, not to harm, but to protect. Nor has the evil ceased. The country is by no means fully supplied with railroads. There will be at least as many more built as already exist, and promotors are to be found ready to sacrifice every principle of honor and play the old game. In some such instances it is charitable to suppose the ultimate disaster was unanticipated, and that it was not intended originally to make the last and destruc-

tive mortgage ; although in such cases it can not be deemed other than an evasive contrivance that left the guaranty unsecured ; but in most cases it has been apparent that the branches then built were leased, and the bonds of these branches floated to the enrichment of either the directors or others interested in the main line, or outside parties who were dishonestly favored. There was no purpose to give to the State its due consideration ; no sincere regard for the public welfare. Besides those held by our own people such bonds in the aggregate of immense value are held in other countries, and when such losses are incurred, not only is dissatisfaction with government created at home, but the fair fame of the State is tarnished abroad.

And more than this. While the corporation is able to continue as a going concern, the struggle to pay interest on such an immense fictitious debt, and pay dividends on stock so issued besides, leads necessarily to constant efforts to reduce all ordinary expenses of operation, and among the rest to cut the wages of employes to the greatest

degree possible. Discontent is thus engendered among the bodies of laborers employed, and if the strike is not precipitated, many are thrown out of employment who otherwise it would be desirable to have at work, and the State again suffers from the feeling that it is not adequate to control the wrongdoers, and who are dealing out injustice to those by whose favor their privileges have been bestowed.

Why this evil is allowed to continue and repeat its work as it does, constantly, it is hard to conceive. With the power of the State to prevent it; with the people, those with capital and those who labor, the sufferers from it; and both means and motive at hand to govern, yet the State does not govern. It would be far easier to have a board to pass upon the right to issue bonds or incur engagements for liabilities to others, which should proceed on thorough investigation of values of the property and already existing debts, if any, by making whose certificate of a sufficiency of assets to justify the indebtedness proposed a necessity, would restrain the corporations either

dishonest, reckless or injudicious action in such matters, than to have those other boards so prevalent in many States who investigate and appraise the properties for taxation or determine the rates and charges permissible for transportation. Indeed it would seem the natural order of government to prevent the creation of indebtedness based on fictitious values, prior to and with a view to render easy and desirable lower freights where they are deemed too high, and there is a constant struggle over the question of whether they are just and reasonable.

“ The visitorial or superintending power of the State over corporations created by the legislature may always be exercised, in proper cases, through the medium of the courts of the State, to keep corporations within the limits of their lawful powers and to correct and punish abuses of their franchises. To this end the courts will issue writs of *quo warranto*, mandamus or injunction, as the exigencies of the particular case require ; will inquire into the grievance complained of, and, if the same is found to exist, will apply such remedy

as the law prescribes. Every corporation of the State, whether public or private, civil or municipal, is subject to this superintending control, although in its exercise different rules may be applied to different classes of corporations." *

It is to this evil, also, that is to be ascribed the dissatisfaction now prevalent with the administration of railroads through receiverships by the United States Courts. These cases, as we have seen, come into the United States Courts because of the particular decisions made by the Supreme Court itself to the effect that corporations can sue or be sued in these courts the same as individual citizens can be, and for the reason that the members of a corporation will, for the purposes of jurisdiction, be conclusively presumed to be all citizens of the State where the corporation is created, and on this footing, the corporation can sue or be sued by a citizen of another State or a corporation of another State, in the United States tribunals. The suits in equity are almost all brought for the foreclosure of mort-

* *State v. Milwaukee Chamber of Commerce*, 47 Wis. 670-680.

gages—the mortgages of the very class of which we have been speaking, and where there is a professed and actual inability to pay, and where a sale of all the property of the company is contemplated. The receivers appointed by the Court have the power to cut off all leases that are deemed undesirable for the road in hand, and the bondholders secured on the leased property are left to their own devices to realize on these separated properties. The receivers are allowed to incur liabilities, which are indeed the debts of the court itself, and therefore, take priority in lien over the very mortgage being foreclosed, and depreciate these bonds still more, while a very great sum in cash has to be paid the receivers themselves for their services, to the master in chancery, and still other sums to the solicitors of different interests represented; and after all these are paid the remainder of the proceeds is distributed to the bondholders of the foreclosed mortgage. During the years that the receivership is progressing to these ends, the railroad is kept a going concern, both because it has a pub-

lic business to carry on and because it is deemed it will so bring more at the sale as a going concern than it would were it allowed to lie unoperated. Delays are proverbially dangerous, and so it has not infrequently happened that during those attendant upon foreclosure, strikes by labor organizations occur and either directly or indirectly involve the particular property in the custody of the court, and thereupon the court issues its writ of injunction forbidding all persons from interfering with the property it for the time controls, and as has sometimes happened also writs of assistance to support the receiver. Under the writ of injunction arrests may be made of all violating it, as in contempt of court, and the writ of assistance may call forth the whole executive power of the government.

The country is now agitated by the discussion of the justice or necessity of these judicial proceedings which end, under the circumstances mentioned, in arrest and punishment by fine and imprisonment of offenders upon investigation by the Court, without intervention of a jury trial,

and without review by any other tribunal if the Court originally acting has had jurisdiction, and so we have the cry against government by injunction. Without at this point entering into a discussion of the merits of this controversy, the fact remains that in most instances these stringent remedies by judicial proceedings are directly the result of the original wrong of an unjust not to say dishonest creation of indebtedness and because the bankrupt concern is taken into the United States Courts. These courts thus incur the dislike of both the great number of bondholders who suffer such great loss from the inadequacy of their security and the very great expense of realizing on what they have, and on the other hand of those who, however misguided and unreasonable feel the heavy hand of authority laid upon them for their illegal and indefensible proceedings. A judge of the United States Circuit Court, of judgment and experience, in a recent address before the American Bar Association, has pointed out the injurious effect of these causes upon the esteem, respect and obedience heretofore given by

all the people to our national judiciary, and he therein, among many other valuable suggestions, remarks:

“The abuses which too liberal charters and insufficient visitorial power permit, are either for the State Legislatures or the State Executive and Courts, by *quo warranto* to correct and remedy. State laws which should forbid the issue of stock or the issue of bonds by any corporation until after an examination by a State Board of Supervision into the affairs of the company, and a certificate that the assets justify it, would do much in this direction. The Federal Courts can do nothing to prevent such abuses, and their action is not usually invoked until the evil is done, and only a bankrupt estate is left to administer.”

This is certainly true, but how great is the condemnation thereby implied of the want of good faith if not absolute dishonesty, of the corporation management, which unless so checked, is prone to heap up the indebtedness from which the bankruptcy comes. Such course of conduct by individuals in their private affairs would bring down

upon them the utter condemnation of society; how much more do they violate their obligations who have been favored with the State's confidence that they will work for the public welfare and through this confidence have had conferred upon them some of the highest attributes of sovereignty, and of the privileges of citizenship. What greater wrong than to inflict upon the government and its courts the slightest suspicion of weakness or injustice in them.

To restrain this evil would harm no one, but would protect all, even the wrongdoers themselves. It would prevent no construction of any roads that could have a claim to exist, retard no development of the country, for that would be taken up by those just as capable and more trustworthy and it would be only so much interference by the State as its dignity and claim to the confidence of its constituents demand. Looking to those companies where the financial management has been just, we find peace and abiding security, turning to those where it has been unjust and indefensible we find bankruptcy, litigation, com-

motion and State degradation. The axe should be laid at the root of this obvious and still continuing evil, and the obligation to conduct honestly the financial operations of the corporation should be stringently enforced.

There is another obligation directly connected with that already discussed, of no less binding force, but where there is exhibited a like disposition of evasion. If the considerations we have presented have weight in illustrating the obligation resting upon those corporations to be more just in incurring obligations voluntarily, they should willingly and promptly respond to the burden of taxation, according to the value of their property, under the laws imposing it on the possessions of all in the State and proportionately. Yet it has been a strange anomaly in our times that the very property that the corporation itself estimates so highly when it is issuing its bonds and mortgages, it immediately, when called before the taxing assessors, depreciates to an extent that puts it in value proportionately below that of individuals. The assessor imposes upon

the lot and house of a citizen a value for taxation often quite as high as it could be sold for and certainly as high as it could be mortgaged for, and the burden has to be met with short discussion. But it is not so with the railroad corporation. The Board of Assessors meet, the companies interested are assembled and arguments are heard, value for the most part lessened and a result attained that even at the lowest is resisted, and the courts, one after another to the highest, resorted to in the hope that somewhere and somehow the obligation may be avoided or diminished. This has been the case where only the tangible property of the companies has been the subject of taxation. But when the States determined to include the franchises enjoyed the conflict deepened. Yet it has been the frequently determined and announced law that these franchises are only grants from the State, but they are protected by constitutional limitations the same as any other property.

“Corporate franchises are legal estate and not mere naked powers granted to the corporation,

but powers coupled with an interest, which rests in the corporation by virtue of their charter; and the rule is equally well settled that the privileges and franchises of a private corporation, unless exempted in terms that amount to a contract, are as much the legitimate subjects of taxation as any other property of the citizens within the sovereign power of the State.” *

This opposition has, however, been justified in many instances by a disposition on the part of the State to impose burdens not only unjust, but which, had they been allowed to continue, would have been confiscatory and a depreciation of property without due process of law. The obligation is mutual to make fair returns and to make only just demands. The power of the State has been used to protect the railroads from violence, and citizens of all ages capable have volunteered to serve in the ranks for this purpose. The State has a superlative right to demand this property shall bear its equal burden for revenue.

* *State railroad tax cases*, 92 U. S. 575-610.

Connected nearly with this reluctance to bear the legal burdens of taxation has been that course of conduct that called into being the Interstate Commerce Commission. The plain injustice practiced, before this restraint was imposed, was that the charges or tolls imposed, in many instances, for transportation, were neither just nor reasonable. Thus, the freight of one man at a greater distance from the point of destination was charged less than that of another at a nearer distance from the same point, arbitrarily and without any attendant circumstances to justify the discrimination. The States were first aroused to control by legislation this and kindred unjust corporate actions; and at length the United States established the commission for the same purpose, known as the Interstate Commerce Commission. "It is competent for the State for traffic wholly within the State, either by direct legislative acts or by the instrumentality of a commission, to superintend railroads as public highways, to require them to report their tariffs of charges, and subject them to revision, and to impose reasonable regulations

in respect to their fares and charges ; but not to impose unreasonable charges, so as to be confiscatory and so in violation of the Fourteenth Amendment of the Constitution of the United States as being a deprivation of property without due process of law or a denial of the equal protection of the laws.”

“The Interstate Commerce act looks to the prevention of discrimination, to the furnishing of equal facilities for the interchange of traffic, to the rate of compensation for what is termed the long and the short haul, to the attainment of a continuous passage from the point of shipment to the point of destination, at a known or published schedule,” and “without reference to those points on the line over which it is necessary for the traffic to pass ;” to procuring uniformity of rates charged by each company to its patrons and to other objects of a similar nature.

The act was not directed to the securing of uniformity of rates to be charged by competing companies, nor was there any provision therein as to the maximum or minimum rates.

And, finally, on this head, we notice that combination of railroad corporations either directly or indirectly combining to fix charges to be exacted, and which, among other combinations of like kind by other corporate bodies, gave rise to the legislation, State and national, termed anti-trust laws.

In *U. S. v. Feight Assn.*, U. S. 166, 319, the Court made the following comment:

“It is said * * * * that a number of combinations in the form of trusts and conspiracies in restraint of trade were to be found throughout the country, and it was impossible for the State and government to successfully cope with them because of their commercial character and their business extension through the different States of the Union. Among these trusts, it was said in Congress, were the Beef Trust, the Standard Oil Trust, the Steel Trust, the Barbed Wire Fence Trust, the Sugar Trust, the Cordage Trust, the Cottonseed Oil Trust, the Whiskey Trust, and many others; and these trusts, it was stated, had assumed an importance, and had acquired a power which was dangerous to the whole country,

and their existence was directly antagonistic to its peace and prosperity."

And again :

" Railways are public corporations organized for public purposes, granted valuable franchises and privileges, among which the right to take the private property of citizens *in invitum* is not the least ; that many of them are the donees of large tracts of public lands and gifts of money by municipal corporations, and that they owe duties to the public of a higher nature even than that of earning large dividends for their shareholders. The business that railroads do is of a public nature, closely affecting almost all classes in the community, the farmer, the artisan, the manufacturer and the trader. It is of such a public nature that it may well be doubted, to say the least, whether any contract which imposes any restraint upon its business would not be prejudiced to the public interest. This occasion does not permit a discussion in detail of the merits of the defense to these last named delinquencies ; and we must rest for our right to mention them

as such upon the decisions of the courts that they are existing illegalities, and injurious to the public welfare.”

The obligation to take all precautions available for the protection of the lives of passengers and employes; to be just in wages, and many others that might be presented are passed, as time will not allow their discussion.

Having thus considered some of the obligations of the railroad corporations, our subject requires us to turn to those of the people towards these creations of the State. The people may be contemplated either as organized in the State, or as the unorganized mass of the community composed of the individual citizens, and let us first consider it in the latter condition, for further on and in conclusion we will have to speak of the State as the collected will, supreme over all in executive power.

This people may be deemed to hold that field of right and action lying between the supreme constituted authority and the organizations under it, and that in which is reserved all the power un-

delegated to the State. This authority constitutional government requires should be exercised under due forms of the law ordained to give expression to the popular will, and yielding willing submission to the ordinance established and to be administered for the welfare of all.

A fundamental obligation here existing is for the people to protect itself by an intelligent study of the benefits conferred by government and just application of its principles to perpetuate these and to eradicate and prevent the evils affecting society or threatening its welfare. It is an obligation resting on every one under a free government to learn the needs of the people and to apply through a personal exercise of the right of suffrage the measures necessary for their advancement or protection. The neglect to meet this obligation is the source of most of the evils of which society to-day complains, in that it allows opportunity for injustice and corruption without remedy or punishment. It is indeed true, as has been aptly and justly stated by an eminent statesman, that "we too much rely upon

the government running itself," and when dissatisfaction arises from its imperfect working we resort to an almost despairing criticism of its usefulness, or to violent and illegal means for correction. The individual citizen demands for himself the protection, under the law, of his life, liberty and property, and for these, by resistance, war and convention, guarantees have been created and embodied in written constitutions. But these guarantees are safe only under that other resting with the people—eternal vigilance, that guaranty of guaranties. They must watch for and protect the benefits evolved, as much as challenge and repel approaching evils. This vigilance should be enlivened by a sense of justice to the rights of all. If impelled by prejudice, distorted by corruption or slothful from indifference, the voting power in a republic is represented by ignorance or the enemies of the very reforms demanded. The fault is not in government, but the governed, and the trust reposed in the citizen is betrayed. It is betrayed as to society, as that is evilly affected; and the trust is most basely betrayed

as the welfare of future generations is endangered. It is a crying complaint of the day that our city municipal governments, our State legislation and even our National Congress are influenced by corrupt manipulation of members of these representative bodies. In so far as corporations are instrumental in securing this criminal and destructive conduct, they should be utterly condemned, and if their influences to such ends can not be otherwise stopped, they themselves should be destroyed. It would be better that every benefit they confer should be rejected and other instrumentalities for our advancement secured than that the foundations of impartial and exact justice should be impaired or discredited. The remedies already exist and their application with the unsparing severity should be demanded wherever guilt in corporation action is apparent. But if the people's representatives are chosen for the public welfare and not to support some private advantage, there will be no opportunity for the corruptionist. There is an obligation resting on us all, commensurate with our duty to our-

selves, and indeed under governmental forms involved in it. The Constitutions under which we live have been established by great sacrifices and are the result of vast experience by our race. And it is our chief obligation to maintain them with fidelity and courage. To corporations within the meaning of the words as used in the constitution, life and liberty can not be aptly applied, as they are when contemplated as the rights of individuals. But corporate bodies are entitled to their legal exercise of such franchises as are bestowed, and in regard to property, including their franchises, they are, equally with the individual, entitled to the full protection of the law of the land. The obligation to regard these rights rests upon others the same as in relation to individuals. Indeed there is not only the same legal obligation, but the moral obligation is just as controlling ; for after all, the corporation is composed of individuals, and these have involved in the security of the corporate body their personal welfare. Moreover, there can be no impairment of a guaranteed right under the law by either a law-

less attack upon it or a refusal to recognize it because belonging to an owner of one kind of property or another without it affects the same right in others and in regard to other property.

There is no safety to the people in the action of those who demand there shall be changes made in the long-established and hitherto well-recognized forms of procedure in the courts by which the guarantees of the Constitution have been enforced, merely because under the peculiar circumstances of our own immediate times, calling them into exercise, these forms have exhibited great efficiency. These circumstances have been themselves most extraordinary and threatening to the public peace, and to the action of the lawless in every instance is to be justly attributed the extraordinary remedies used by the courts for the maintenance of property and government. The processes used have not been novel. Their origin has been traced to the times long past, and their application as recently used approved by the Supreme Court of the United States. They are a part of the law of the land. They have been

known to all the people when the guaranties we enjoy were ordained by their representatives, and may be fairly said to be a part thereof. The writ of injunction that prohibits a lawless attack upon property, or a reckless obstruction of the functions of government, has proven an efficient process of the law to secure at least a fair hearing on the merits of the case, and prevent the destruction in advance of the very central right to be brought before the court for its consideration and determination. It has not been passionately or inopportunely resorted to, and it has wronged no man. What person, against whom the proceeding has been had, has established or sought to maintain that he was innocent of any conduct lawfully subjecting him to its power? The right of the courts of chancery to issue the writ of injunction and to try by the court itself, violators of its command, without appeal, has grown up along with the right of trial by jury. They are both results of the same experience and wisdom, and equally entitled to our confidence as a means of administering justice. Proceedings by and under the writ of injunction

are objected to, chiefly, it would seem, because of their efficacy to determine the guilt of and punish the offender. The complaint seems to be not, indeed, that any one has been unjustly condemned, but that some, if they had only had a jury to try them, might have escaped in any event. It has, indeed, been speedy, but only where forces were to be met that were arrayed and rapidly proceeding to lawless and destructive results. Where there is no considerable portion of the community interested in the result, other than that justice should be done, it is often difficult to secure a verdict, because of the unanimity required to produce it. Taking a time and locality of great commotion among the people, affecting the commerce and social intercourse not only of one section, but of the whole country, now so interdependent in every part upon the harmony of the whole, and have it the law that whatever necessity the court may be convinced exists for restraining an alleged interference with the constitutional rights of a part of the people, it may, indeed, issue its restraining order, but all violators of it must be tried

by jury with right of appeal, and who does not believe that the writ will be ineffectual, because its violation will have no sufficient and immediate penalty that men so arrayed and aggressive in great numbers will for a moment regard. The plea for the trial by jury in such cases is to overthrow the restraint that should be imposed on those who would condemn without hearing, proceed without judicial inquiry, and having substantially destroyed the right of the opposing party, expect the merits of the claim to be adjudicated afterwards, if at all. This method is akin to that which would disarm the State from protecting its courts, its mails, its treasury or any of its property by its own right hand, and compel it to await the consent of its constituents whether States or citizens. This is not the safe or reasonable means of government. There is just as much need of a preservation of the subject of controversy by preventing its destruction as of adjudicating ultimately to whom the same belongs.

There is, however, above and beyond all these obligations on the one side and on the other, a

mutual obligation resting upon citizens among themselves, of corporations, and of the States of the Union and the National Government, of greater forbearance and conciliation, one towards another. We stand among the nations of the world as a self-governing people, and for an hundred years and more we have maintained with wonderful success a constitutional republic. The Constitution was framed on compromises. States, small and great, were given for the most part equal power to control legislation; local institutions unapproved by other sections were left unchallenged where they were; the public lands, owned by some of the States, were bestowed upon the United States, and to the National Government was given the control of the interstate commerce and that with foreign nations. There was a confidence reposed in the governments of the States and of the United States that they would administer public affairs in justice and with loyalty to the republican system. Where franchises were given by the State it was in the belief that they would be exercised for the public good. And

to the people was reserved the power of correcting all evils, through the people's virtue, intelligence and right of suffrage. And being one people, seeking and enjoying civil and religious liberty, our waste places were rapidly occupied, and neighborly feeling was not confined by State lines, but expanded through all the land. There were political parties, fierce and aggressive in the assertion of their respective principles, but there were no classes; those who lived on their incomes were not separated from those who depended on daily labor. We prospered because we were at peace with ourselves, and had a hearty fellow-citizen attachment for each other. It has resulted that under so much and well protected liberty of individual action, the vast resources of our continent in their development have made some rich, a few wonderfully so; but surely no part of our countrymen are poorer than were a proportionate part of our fathers; nor, indeed, so poor as they, in either material possessions or in all the conveniences of social intercourse and personal enjoyment. Those now

deemed by some as in the control of unwarranted privileges of wealth and consequent influence, are the sons and descendants, in most instances, of the poor of our earlier days; and it is open to common observation that the changes of fortune are so rapid in America as to justify no man in designating as a permanent class, or a class to last from one generation to another, either the rich or the poor. The mouth of the demagogue even, as he stirs up strife against others, is often closed by the advent to himself of sufficient wealth to make him conservative and silent. There is no public opinion to support the attempted discrimination of class from class. Public opinion does not mean the opinion of a party or a section or a portion of the community. It is the opinion of the mass of the people of all conditions, and it is based upon the appreciation of fundamental truths acknowledged by all. It is a power more potent than physical force, and it carries with it peace and charity. This public opinion exists and it is in favor of the Republic, and refuses to act upon the pretension that because some differ

from others in talents and possession we are not all fellow-citizens, or that this government can not or will not be borne safely through another century. It believes it will, and for many another century after this. It has been demonstrated, both in Europe and our own country, that when formerly resort was made to strikes and lockouts, boycotts and riots to attain the ends of employer or employed, and where even arbitration as a remedy failed, the system of conciliation has been and continues to be effective to allay antagonism and secure all parties in the employment of their mutual rights and enforce their mutual obligations. This system or principle of conciliation is that by which the discontented parties are brought to a mutual conference, to talk over their differences, not with a view that one shall control or rule or out-influence or out-vote the other, but that all may come to a fair understanding of the trouble existing and consult upon a means of adjustment. Let this principle be extended to all such controversies, and an era of good will will ere long leave to the demagogue

but little of the prejudice, passion and ignorance upon which only he can thrive and disturb communities. We may find it difficult to obtain a general acceptance of this system for a while, for we have so many inhabitants now imported who have not yet become imbued with a love or knowledge of either our customs, our affairs or our republican principles, that they can not be expected to be influenced to any considerable degree by a love of our country or an appreciation of our government. But the American spirit yet dominates our nation, and will yet bring into harmony and health all these discordant and dangerous elements. Men of affairs everywhere are politic. They know that ultimately success must rest upon that good will which comes from a mutual recognition of each other's rights.

But, in conclusion, let us not deceive ourselves by hugging to our bosoms delusive hopes that physical force can be dispensed with altogether.

The State must be supreme, and where nothing but force will serve, must be used to preserve the law and order, and to require that changes, if to

be made at all, shall proceed along the well-marked paths the constitution itself provides. The ballot-box, the legislative bodies, the convention, the orderly expression of the will of the majority of all the citizens, are the only legal means by which the principles of some may be made binding upon all. Whatever obligations exist and however flagrantly disregarded by those upon whom they rest, they can be enforced only through the forms of legal procedure. Whatever rights men may be entitled to, and however violated, their protection must be sought through the courts and under the sanction of the law. To this end is the State created and armed with power. It must maintain and enforce the law as it is. It guards the weak and restrains the strong until disputed claims may be adjusted. The purpose is peace and security, but if violence is resorted to to defeat this purpose, it becomes the most violent and restores quiet by superlative aggression and force. It maintains itself by protecting the community. It has the first and pre-eminent right to be and to be respected. Beneath

its protection all are equal in right, and beneath its power none can impose opinions upon others by them unrecognized and unassented to. Its voice is law, and on the field of violence its injunction is the bayonet. The fathers of our republic, the people of this nation, have hitherto prospered most because of a reverence for law, and because any resort to violence was condemned utterly as unrepulican and un-American. Let us not lose this reverence. There is no reason why we should. Our courts have done nothing in secret; their opinions, when most criticised, have been expressed plainly and upon reasons and authority. Those of our National Supreme Court have been worthy of its high reputation for candor and impartiality and a high sense of justice. When dissent existed it has been fully heard and expressed. Where change of opinion has occurred, it has been upon acknowledged error. The American Courts, State and National, are respected in foreign countries for wisdom, learning and integrity. We have no cause to disparage them at home. They are the product of our republican system. Their

members are patriotic citizens. Those of the States, for the most part, are selected by the people themselves; those of the United States, appointed upon the approval of the States through the Senators in Congress. There has been no change in the constitutions of any States that have come into the Union, either at its inception or since, from the plan of making the judiciary co-ordinate with the legislative and executive departments, and there is no reason to believe there ever will be so long as our republican governmental form exists. The court is, and must remain, the sole expounder of the law, and to the enforcement of the law thus expounded and adjudicated the State and the people stand pledged, not alone by the expressed constitutional provisions, but also by an intelligent regard for its own safety of society. Let us, then, ourselves respect the law, and demand that it be obeyed, even if it be respected not by others, and let us each perform his own obligations, whether as an individual or in any representative capacity, and when differences arise let us seek their peaceful settlement

by conciliation and good will. But, if it can not be otherwise, let us maintain the State, its courts, its laws, by whatever of power to secure the right God has given us.

IV.

RELATION OF RAILWAYS TO THE STATE.*

ADDISON C. HARRIS.

I purpose to discuss the relation of railways to the state, to the people, and to their employes. To-day the subject will be that of railways to the state. By state, I do not mean simply an American state, but rather the whole people of a body politic in the sense of a commonwealth or nation.

Every community, savage or civilized, will in some manner have means of travel and inter-communication. The Indians made trails through the forests. In Africa the country is covered with a network of paths that lead from village to

* Reported by Miss Merrill.

village, and one of the first steps toward civilization is the opening or maintenance of public highways.

In the old time when the Romans conquered a people and established a province, the first step was to open up highways leading from the inland to the sea, so as to provide a means of commerce, and as Rome grew in power and wealth she established magnificent roads leading from the capital city in every direction throughout Italy, the most important and best known being the Appian Way, which was three hundred years old at the beginning of the Christian era, and is in use to-day.

Many years ago I was much impressed with the remark of an old farmer who came to consult me touching a public road, and asked me whether it was not the law that "every man has a right to have a road to meetin', to market and to mill." This may well be taken as a maxim, for there can be no civilization and progress unless every person in a community has the means whereby he may find a market for his produce,

and a place where he can exchange that which he produces for that which he needs.

It is apparent, therefore, on reflection, that as the first step towards civilization, roads and means of intercommunication must be opened and maintained. As the individual can not do this, it naturally and conclusively follows that it must be done by the state. And so it is in the very nature of things the bounden duty of every government to provide for the use of its people roadways, so that they may interchange, visit and communicate with those about them. This is so essential and has been so long understood that we no longer question the power and duty of the state in this regard. We see about us on every hand streets, township roads, county roads and state roads, laid out and maintained by the power of the state.

The general government, for the purpose of opening up the great west, many years ago built the great highway known as the National Road, leading from the east across the Ohio and Mississippi valleys to St. Louis, and afterwards the

general government built the great railways reaching from the Missouri River to the Pacific Ocean.

States and communities, in like manner, in various ways have aided in the construction and maintenance of railroads throughout the country.

Is there any difference between a township road, a county road, a state road or a national road in its relations to the township, the county, the state or the nation?

Each and every roadway is an avenue established by law and maintained at public expense in some way, whereon the people have a right, without trespassing upon the rights of any other, to carry their product to the market, and transact the other business of a civilized community.

It matters not whether the road is used as a footway, a wagonway or a railway, or whether the vehicle is a carriage, a stage coach or a car, the way must be provided by the state. Neither does it make any difference whether the vehicle is moved by animal power, steam or electricity. In any case, regardless of the vehicle or of the

power, in principle it is a public road, established and dedicated to public use.

In England roads came to be called the king's highways, for the reason that at a certain time the government assumed the duty of building and establishing public roads leading from London to the various cities and ports, and, it is said, because they were graded above the common level they were called highways. And they were the king's highways for the reason that they were built under the sovereign power of that country. The people are sovereign in this country in the person of the government; in England, in the person of the king.

Now, if I have made myself clear, we have it somewhat tersely and briefly stated that a road is a highway for the use of all, established and maintained by the sovereign or government for the use of the people.

Originally, or at least in theory, under English and American law, all title is derived from the king or the government. This implies that the crown or the state was at first the primary owner of

all the land and country. And so it is sometimes said that when the crown or state divides the lands and gives or sells them to its citizens, that, by necessary implication, the government reserved the right to appropriate and use so much of the lands thereafter as might be necessary for public roads. At most it is within the power and duty of any civilized state to appropriate so much of any one's property as may be necessary for the purpose of a public highway. This is sometimes called a sovereign right or a governmental right. In my profession we speak of it as the right of eminent domain; that is to say, the prime or first right which the government has over all the country to take so much of it as may be necessary, against the consent of any separate and private owner, and appropriate it to the use of the whole people.

No one doubts the right and power of the government to take the property of its citizens, in part or all, in time of war, if necessary for the public defense and the maintenance of the public welfare. But peace is as important as war, and

it is as essential and proper that the state shall take property for the use of a highway as for the maintenance of a fort or any other necessary and public use; and it may be taken through the agency of a township to establish a township road, or a county a county road, or a state a state road, or by the nation for a national road.

In the earlier ages there was no duty incumbent upon government to pay for property appropriated in war, and sometimes it was neglected in peace. To secure the right of the citizen in this regard, it is now provided by the constitutions of all the American states that property of the citizen shall not be appropriated for public highways without compensation being made to the private owner.

When a state directly appropriates property and establishes a road, it is easy to understand that it is the property of the state devoted to the use of all its people. But, generally speaking, railroads are not constructed immediately by the state. When railroads first came into use the American states were unable to raise the means

necessary to build and operate these great and necessary highways. And so, instead of building the roads directly, and levying heavy and recurring taxes upon the people to maintain and operate them, the right to build and operate the roads was conferred upon certain of its citizens and their successors, who were united in a body called a corporation and endowed with all the rights of an individual, and given continual succession, or, as it is sometimes said, perpetuity. To this body the state transferred the power of eminent domain, and all the other powers held by the state necessary to the construction and maintenance of a road.

In this land of peace it is not always easy to conceive of a railroad, owned and operated by a body of citizens united into a corporation, as a public governmental agency. But if you go to a nation which is engaged in warfare, and where the government is maintaining and transporting armies from the interior across the country to the frontier, it is easy to regard a railroad as a governmental, military highway. So, in many

countries, railways are built and maintained as a part of the means of national defense. This is so in France and also in Germany and Italy and other nations of the continent. In those countries which are in a continual state of readiness of defense and warfare, the railroads are generally established and operated directly by the government itself. But it is not necessary that the government should own a railroad in order to control it. An illustration of this may be found in France. There no railroad can be built except by permission of the government. No parallel lines or competing lines are permitted. The cost of construction is paid, not out of the public chest, but by private persons or stockholders; yet the road, when built, is regulated and controlled directly by the government. The whole operation of the railroads in France is under the supervision of the Transportation Bureau, so that the speed, the fares, even the style and character of the cars, are determined and fixed by governmental agency. The company can make no alteration in the machinery or rolling stock unless it is submitted

to and approved by the governmental department.

I remember reading in a newspaper while there of a passenger who brought a suit against a company because his hand was caught in a car door and injured. The railroad plead in defense that the door was of a different design from that generally in use, that it was compelled to use this new style of door by direction of the government, that the plan was defective, thereby causing the injury to the passenger; and so, it said, it was not liable in damages for the injury sustained. Nevertheless the French court held otherwise and required the company to compensate the injured passenger. And, on reflection, perhaps this is not unjust, for the reason that a French railway is not private property in the sense in which that term is commonly understood, but is private property devoted to a public use, and in its use the government has a right to direct the manner and means without assuming the liability consequent upon any defective or improper use.

England and America have, in the main, been

at peace. Neither keeps large standing armies ; neither has a frontier which must be continually guarded against invasion. And so, in these countries, a railway is not, in the public eye, a military road, but a peaceful enterprise ; and thus it has been more or less difficult to get all the people at all times to comprehend and understand that an American and an English railway are public highways.

Of course, during the late civil war, the government laid its hands on the railroads in the states, as well as the other highways and means of transportation, and used them for military purposes. It was the right and duty of the nation to do this, but it was not impressed upon the public mind that it was being done through the sovereign power of the government to travel upon public roads, but rather as the taking and using of property for the public defense and welfare.

Now, I want to invite your attention to the exact relation of the American railroad to the American state and the United States.

We have seen that a railroad is not, any more than a turnpike road, a private enterprise. Its owner is created by means of law to carry out a public purpose for the public good.

When railroads were first being established in this country it was the common thought that they should be held and owned, as well as used, by the state. Many of the early charters so declared. Thus, as an example, one of the charters granted in this state on which a railroad was established and is still maintained as one of the leading lines, provided that, "at any time after the expiration of sixty years, the state reserves the right to purchase, said road by paying said company the entire cost of constructing said road and keeping the same in repair, with six per cent. interest thereon."

A charter in the State of Ohio, connecting a line with the one above mentioned, provided that, "if the legislature shall, after the expiration of thirty-five years, make provision for paying the company the amount expended on the road and six per cent. interest thereon, less dividends paid,

then that such road shall vest in and become the property of the State of Ohio."

Some of the other states about the same time passed similar charters.

The Legislature of Pennsylvania conceived that the company should build the roadway, provide the motive power, and that the shippers should have the right to furnish the vehicles in which their products and merchandise should be carried over the road.

But the magnitude of the capital invested in the highways of the country and the great volume of the traffic has diverted the public attention from the primary concept of the railway, until now we seem to forget the true relation of the railway to the state, and are wont to regard it as a private enterprise; yet hardly a freight train passes before our eyes but we see the cars of private owners laden with beef or beer or other merchandise, being hauled in compliance with the old notion that the shipper should provide his own cars.

Throughout the western states many railroads

have been in part at least built by moneys raised by taxation and donated or subscribed to the railway company. No one would think for a moment that the state had power by taxation to raise money to build a factory or establish a dry goods store, or tile, or otherwise improve a farm; yet in the general mind railways have commonly been thought to be private property like a factory or a farm, and so, many years ago, a man entertaining such views resisted the payment of taxes levied upon his property for the purpose of aiding in the construction of a railway through the county, and the case ultimately got into the Supreme Court of the United States in 1872. In that case that great court stated with exactness the precise relation of the American railroad to the American state as follows:

“ That railroads, though constructed by private corporations and owned by them, are public highways, has been the doctrine of nearly all the courts ever since these conveniences for passage and transportation have had any existence. Very early the question arose whether a state’s right

of eminent domain could be exercised by a private corporation created for the purpose of constructing a railroad. Clearly it could not unless taking land for such a purpose by such an agency is taking land for public use. The right of eminent domain nowhere justifies taking property for private use. Yet it is a doctrine universally accepted that a state legislature may authorize a private corporation to take land for the construction of such a road, making compensation to the owner. What else does this doctrine mean if not that building a railroad, though it be built by a private corporation, is an act done for a public use? And the reason why the use has always been held a public one, is that such a road is a highway, whether made by the government itself, or by the agency of corporate bodies, or even by individuals when they obtain their power to construct it from legislative grant. It would be useless to cite the numerous decisions to this effect which have been made in the state courts. * * *

“Whether the use of a railroad is a public one or a private one depends in no measure upon the

question who constructed it or who owns it. It has never been considered a matter of any importance that the road was built by the agency of a private corporation. No matter who is the agent, the function performed is that of the state. Though the ownership is private, the use is public. So turnpikes, bridges, ferries and canals, although made by individuals under public grants, or by companies, are regarded as *publici juris*. The right to exact tolls or charge freights is granted for a service to the public. The owners may be private companies, but they are compellable to permit the public to use their works in the manner in which such works can be used. That all persons may not put their own cars upon the road and use their own motive power has no bearing upon the question whether the road is a public highway. It bears only upon the mode of use, of which the legislature is the exclusive judge.”

Olcott v. The Supervisors, 16 Wal. 694.

The use of most of the public roads is free to all. A township road is maintained by a township tax; a county road by a county tax; a street

by a city tax. Formerly, turnpikes were, generally speaking, made and owned by corporations created in the same manner as railroad companies, and a toll was charged for their use in the same manner as tolls are charged for the use of railways. But now most of these turnpikes have been purchased by the counties and converted into public roads. The purchase money has been raised by taxation. So, many turnpike roads are now built by taxation and are known as free gravel roads. The same power which can purchase or build a free turnpike road could purchase or build a free railroad. But the power has never been, and it is not probable that it will be, exercised in America so as to make free railroads.

The fare which a passenger pays for the use of a railroad is in the nature of a tax for such use, collected ordinarily at the station before the passenger enters the train and enjoys the use. So the freight money paid for transportation is likewise a tax. A person engaged in a private business may sell his goods, wares and merchandise at such prices as he may fix. They may

change from day to day. Prices of all commodities are changing daily in the public markets. But a railroad has not the right to fix the fare at its own pleasure. The state has the right to, and often does, fix it at so much a mile or ton or car. And if a state does not exercise this right directly by a statute, the courts regulate and control it, and will not permit a railway company to charge by way of a tax—*i. e.*, a fare—more than a reasonable sum for the use of the railway under all the circumstances.

The state may not only regulate the tax for the use, but it may and does exercise the sovereign power in many other ways. It may regulate the speed. The legislature has conferred this power upon the cities and towns throughout this state. They exercise it without stint.

In many states laws are made providing that engineers shall pass an examination as to the sufficiency of their eyesight before engaging or continuing in the service. One who is color blind is not a safe engineer. So regulations may be made touching sobriety. In this State, and in

almost all the states, the conductors are vested with police powers and may maintain peace and order in a car and arrest and imprison and expel a disturber of the peace without process or warrant. No person engaged in a private business could be clothed with such powers.

Immediately after the thirteen American states had established their independence, each state claimed, and exercised in a general way, the sovereign powers of any nation touching commerce passing in and out of such state. Each state then had the right to make a tariff for itself and levy a tax upon the goods, wares and merchandise coming into the state, or, indeed, going out of the state. This soon led to a very bitter feeling between the states, many of which passed severe and arbitrary and retaliatory laws. The security and perpetuity of the United States was put in imminent peril. At the suggestion of Washington and others a convention was called, which ultimately formed and presented to the country our present constitution. It was found necessary, for the maintenance of good feeling

and of the perpetuity of the nation, that this power should be withdrawn from the states, and so it was provided that Congress alone should have power to regulate commerce between the states. This meant, of course, that the states transferred this power of regulating or taxing commerce passing from one to the other entirely to the general government. Under the exercise of this power Congress, some years ago, passed an act known as the interstate commerce law, regulating, in some measure, railroads engaged in traffic moving from state to state. This is an immense power. As yet the government has not undertaken to fix a rate or fare, but only to prohibit partiality and enforce the common rule that all persons shall be treated alike when using the railways for such traffic under similar circumstances. It is a great and growing power. It is not improbable that the members of this class, during the course of their careers, will see the power exercised to the extent that the government shall take a much greater control of the railways throughout the country, establish a railway department, and

place at its head a chief officer and give him a seat in the cabinet. This is the way in which railways are managed in other countries where they are owned by the nation, and also in France, where they are owned by private stockholders.

Institutions grow and develop by reason of public necessity and demands of the people. Great forces are now at work in the railway world, tending to compel the various companies to merge and unite themselves into fewer and longer lines. In many instances the policy and legislation of the states has been felt by the railways to be antagonistic and oppressive, and they are seeking to escape from future hardships and to place themselves under the control of the general government. And it is not improbable that at no very distant day the great interstate and transcontinental lines will be almost wholly taken from under state control and placed under laws framed by Congress in the exercise of its commercial powers; and in this way the railways will be brought back to the original purpose and conception of public highways for public use.

And then it will be easy again to see the true relations existing between these great highways and the state, represented by the entire nation. And it is not improbable that such a result will be found beneficial to all the people. This is the true relation which should exist between these great highways and the people; because, taking into consideration the use and traffic, the railway system is national in its extent and service, and should be national in its government and control.

V.

RAILROADS AND THE PEOPLE.*

ADDISON C. HARRIS.

IT IS self-apparent if a railroad is regarded as a public highway, that everybody has a right to use it. We can hardly think that any man has not a right to walk upon any street or drive upon any state road, or a county road, or a township road; but we do not always as easily think that everybody has an equal and similar right to use a railroad. That comes from the fact that many of our railroad people, and other people as well, have a notion that a railroad is private property, instead of being a public institution; and it is for the purpose of bringing our minds closer to the relation of the railroads to the people that I invite your attention this afternoon.

*Reported by Mr. Evans.

We would open our eyes in surprise at the inquiry, whether everybody has not the right to use our federal postal system. Of course, everybody has such right. Now, what is the postal system? It is a function performed by the government for the transmission and intercommunication of mail matter and news. But it does not stop there. Our government carries books and merchandise; and congressmen send seeds and the like to their constituents; and the only reason the postal system does not grow into a broader service is simply because Congress has not seen fit to enlarge it. Congress puts limitations upon it, and properly.

During these Christmas times you will see every postman who goes about the town laden with goods, and books, and toys, and merchandise, within a certain weight, being delivered by the general government.

And so, if you travel upon a German railway, you find the government, through the small package or parcel system, carrying the linen of the students in the schools and universities, home and

back, every week. Indeed, all small parcels are carried by such service in many countries. It is the same in principle exactly as the carrying of the mails. When we put a package in the postal system, whether it be a letter or merchandise, we must first pay the charge. We put a stamp on the letter. We know what the charge is. It is a tax.

It is like the tax levied during the war, by stamps, upon checks, deeds and other instruments. But if it is a package, we ascertain the weight and pay accordingly.

So, if one goes to a telegraph station for the purpose of sending a message, which is carried, not mechanically but legally, exactly like a letter, we are ordinarily required to pay the cost of transmission in advance. That, too, is a tax for the use of the wire during the conveyance of the message.

If one goes to a railroad company and asks it to carry goods, or to take passage, it has a right to demand payment in advance, just like and as the government demands similar payment for postal service.

In so far as carrying passengers is concerned, it is almost the universal practice to require the payment of the fare or tax, in the nature of the purchase of a ticket, before the commencement of the service. But as to the carriage of goods, the rule is ordinarily otherwise. While the company has the right to demand and collect the tax or charge in advance, yet it may waive this, and usually does, not collecting until the goods are delivered to the consignee; but it has the right to retain the goods until the tax is paid.

So I want every member of the class to grasp this and hold it firmly—that every sum paid by one of the people to a railroad company for the carriage of his person or his property is a tax, which is levied for the service rendered by the railway.

It is elementary, known not simply to lawyers but to everybody, that taxes must be equal. It will not do for a state or a city to tax some people or their property at higher rates than they tax other people or their property.

If government levies a tax on the poll, as is common, then every man must pay so much head tax, whether he has a wise head or a foolish head.

So, if property is taxed it must be at a per cent. on the value, regardless of the ownership. You can not tax a rich man's property more, or a poor man's property less. Neither has government any right to tax property for any more than is ordinarily and necessarily required for the administration of the government. Any taxpayer may rebel if taxes are levied against him which are not to be used for governmental purposes. You can bring a suit and the courts will stop it.

So, now, if a railroad fare is a tax, and as all taxes must be equal, it follows, without further argument or illustration, that the tax which the railroad charges for freight carriage or passenger service must likewise be equal, under similar circumstances.

And so it is in theory ; and so it ought to be in practice.

It is so, generally speaking, in relation to the carriage of passengers. Of course there are certain special rates allowed for picnics, theatrical parties and the like, but these are exceptions to the rule. Yet, when it comes to paying the tax for freight service, it is not and has not been the invariable practice for railway companies to levy the same tax upon every man's property for the same service; and that is what has caused much discussion throughout the country and resulted in the law heretofore spoken of as the Interstate Commerce Act.

What brought about that law? It was because the railway people—I mean the superintendent, president and directory—came to think that every road was a private affair, and they could operate it as they pleased, and had a right to charge one man more than they charged another. If so, let us see the results.

Say here are two men doing the same business in the same city or town. It was not an uncommon thing to give one man a special rate. How long could the other survive such competition?

Thus, if a railroad should agree with a grain dealer in LaFayette to carry for him to the sea-board for one or two cents a bushel less than it would carry for anybody else, he could have a monopoly of the business. The man thus favored can and will crush every other grain dealer out of the market. That thing went on in many kinds of traffic for years and years, over the chief and important lines in the country. The courts tried to stop it, but courts are slow and cumbersome, and men suffer evil long and patiently rather than enter into a struggle with a great railroad company.

At last Congress, under the power which I mentioned, of regulating commerce, laid its hand upon the subject, and passed certain laws and regulations for the purpose of compelling railways engaged in national commerce to perform their simple duty of taxing everybody equally for the same service.

This is all I care to say upon this subject. It is enough, when we come to fully comprehend that a railroad is a public road; that everybody

has a right to travel upon it, and have their goods carried, and everybody must pay a tax, and all taxes must be equal in proportion to the service had—it is enough, I say, to state the elementary principles of that branch of railway jurisprudence.

But another illustration proves the rule that a railroad is not a private enterprise or affair. Thus, any man who is carrying on a private enterprise may stop business whenever he pleases. A hotel, which is something of a public institution, inasmuch as it must receive all travelers who seek entertainment, may close its doors; so, a farmer may quit tilling his fields; so, a dry goods merchant, machinist, blacksmith or shoemaker may stop business at pleasure; but a railroad, as I say, is a public institution, and can not stop.

Would any one think that a turnpike company, having a right to charge tolls for traveling upon its gravel road, has a right to shut its gates, put fences across the road and stop travel? Of course not. And why? Because it is a public road, and being public, it must be left and kept open; and if a turnpike company does not want

to do business upon it, they must leave it, nevertheless, for public use.

On the same principle it must follow that a railroad can not stop doing business. It matters not, so far as the people are concerned, whether the railroad is paying dividends, large or little, or none at all. And if the time comes when the company can not operate its property, then somebody goes into a court and its administration is put into receivership; that is, the court takes the road, operates and maintains it for public use until such time as some purchaser will buy the property and continue the use.

If the practice were that railways should permit everybody to put their own cars upon the roads, or if the state owned and ran them, then it is easy to see such would be public roads. But under the general custom in this country, the railways alone undertake to furnish the car. That being so, they must furnish enough cars to do the service, and if they neglect or fail or refuse to furnish cars when called for, they are liable for any damages ensuing thereby.

I had an interesting illustration of that not many years ago. Without stating the reason why, a certain railway company thought it would serve its business interests to refuse to furnish a certain grain dealer with cars. He had a large amount of wheat which he had sold and wanted to ship to the seaboard, and demanded so many cars for so many days—say twenty cars a day for thirty days. The railway refused to comply with the demand, put their empty cars on a switch outside of town, and directed the station agent not to furnish them to be used for such service.

If that superintendent had understood, or reflected for a moment upon the relation which the railway sustains to the public, he would not have been guilty of saying that he would not furnish cars to haul wheat for one member of the public. But yet he did, and it took a long while for the shipper to get at the railway through a lawsuit.

I might say I tried to protect the railroad, but the judgment came, and well came, that the company was bound to pay damages to the full

measure brought about and caused by this refusal of a public duty.

The railway statutes of Indiana rest upon the basis that railways are public institutions, and so the laws provide that at all crossings the lines shall be connected with "Y's," so that traffic moving on one line may be put upon and forwarded on another.

I want to go back a moment and point out the evolution of the railway and the growth and application of the laws which more particularly apply to certain branches of the business, that is, carriage of freight and carriage of passengers; because the law, upon whatever subject it may be, is the growth and application of the demand or necessity for appropriate rules of action, and it is particularly illustrated in what I am now about to say.

We have seen that roads are made for the public use. Why is a road improved? It is that the power which is applied to the movement of vehicles may move a larger weight than is possible on an unimproved road.

Two or three centuries ago, in England, there were large coal mines some distance from the waterway upon which the coals were carried to market. As the population of London increased, the demand for coals grew to be enormous. And these people had to haul their coals in wagons, over, let me say, dirt roads, some miles before reaching the vessels upon which they were put and carried to London. The time and money necessarily expended in this short haul was enormous, and so here was a demand for a better road from the mine to the waterway. In time a man by the name of Outram thought out the idea that he would overcome this difficulty of a muddy road by laying two parallel wooden sills, smooth and hard, upon which the wheels of the wagons could be made to run, which he saw could be accomplished by putting a flange on the wheel, either on the inside or the out, or, like the grasp of the hand, over both sides, and thus hold the wagons on the rail.

It was found to be a great improvement in roads, and horses could draw five or ten times as

much tonnage over that road as over the dirt road underneath, and from thence till now all such roads are named, after the inventor, "tram-roads."

In time the concept came, why not put a stage coach on such a rail so as to move faster and carry more passengers? And so in time such lines were operated, more or less, in England.

In Charleston, South Carolina, an ingenious mechanic—perhaps I ought to give him a higher title—thought out that he could put a horse in a tread on a car and thus create the power to move it on the rails. He did, in fact, make for a time a successful horse-power car.

The same thing was done in Baltimore, and trains were moved at a speed of twelve or thirteen miles an hour.

As this thought was ripening into better appliances, the time came when Stephenson, an English engineer, conceived that he could put a steam engine on a wagon or vehicle, and pull other vehicles behind it along a tramroad and

use iron rails. While he was not the first, perhaps, to think of it, he was the first to work out a mechanical and commercial success.

At the time of Stephenson's invention the width of the tramroads was four feet eight and one-half inches, and so he made his steam locomotive to fit the tram rails.

Shortly afterwards an English locomotive was brought to America to be used upon one of the lines out of New York City. It was built with the same gauge, and from that we have the standard gauge throughout the United States.

In short words, that is the mechanical evolution of the railroad.

Now, as to the legal evolution.

Long before railroads, there had been established and maintained in England lines of stage coaches engaged in the business of accommodating passenger traffic. Also lines of vehicles engaged in the carriage of goods over the country.

The condition of society in those times is familiar to every one conversant with English history, and is best illustrated, perhaps, in the character

of Jack Falstaff. Jack and his friends, when they wanted money, having no honest way of gaining it, became, as they styled themselves, “Gentlemen of the shade”—that is, they went on the road at night and robbed people. They not only cut purses from travelers, but they took goods from the carriers. Under the old Roman law, which for many centuries was the law of more modern Europe, and England as well, it was a good defense for a carrier to say that the goods had been taken from him by force, so that he could not deliver them. This defense, perhaps honest enough at first, came to be abused. Indeed, the carrier would not protect his goods. He even might enter into a conspiracy with these robbers to divide. And so, about two centuries ago, an eminent English jurist made a new rule for England, and declared that thereafter the losses by thieves or robbers were to be borne by the carrier, unless he could show that he was deprived of the goods by an act of God or the public enemy. He said:

“Though the force be never so great, as if a multitude of people shall rob him, nevertheless he is chargeable; and this is a politic establishment derived by the power of the law for the safety of all persons, the necessity of whose affairs oblige them to trust this sort of persons that they may be safe in their ways of dealing; for else these carriers might have an opportunity of undoing all persons that have any dealings with them by combining with the thieves, and yet doing it in such a clandestine manner as would not be possible to be discovered; and this is the reason that the law is founded upon.”

And this has been the law of carriers from thence till now for all English-speaking peoples.

And, as governing stage coaches, the law was made by another English judge to be as follows:

“The coachman must have competent skill, and use that skill with diligence. He must be well acquainted with the road he undertakes to drive, he must be provided with steady horses, a coach and harness of sufficient strength and properly made, and also with lights at night. If there

be the least failure in any of these things, the duty of the coach proprietor is not fulfilled, and he will be answerable for any injury or damage that happens."

You will thus see that the carrier of goods was made an insurer of their safe carriage and delivery, unless and until he could show that their loss was caused by an act of God or the public enemy; and the public enemy meant citizens of another country at war with England. But as to passengers he was not an insurer, but he was required to perform the rule above stated, that is, exercise a very high degree of care. And this is the law to-day.

Now, let us turn to the mechanical evolution a moment.

The human mind is so slow, that in England and upon the Continent the change of power from animal to steam could not arouse the human mind to use another vehicle than a stage coach; that is, they kept the old form of entrance at the sides and mechanically put two or three stage coaches upon the same pairs of wheels and made

a car. To-day you may see the sides of the passenger cars in England molded into the shape of two or three stage coaches joined together.

In this country the passenger car is the evolution of the omnibus, in which we enter from the rear; and the covered freight car is nothing more than a covered wagon, or, as they were used in England, a large box which they called a van.

Now, when these stage coaches and vans were equipped and put upon iron rails, and the power changed from animal to steam, the courts could not see that there was any legal difference in the status of the company and its relations to the goods and passengers being carried. It was one and the same in law whether they were hauled by horses or locomotives. And so the English and American courts took up these rules which I have read and applied them to railways, both in England and America, and such are the rules to-day.

How hard it is when a thing is once fixed as a maxim in general use, or as an institution or invention, for the human mind to break away and

rise above it. The engineer in the cab to-day sustains the same relations in law as the coach driver on his box. The engineer must have competent skill. He must use that skill with diligence. He must be well acquainted with the road he undertakes to drive his engine over. He must be provided with—not stage horses—but a safe and trustworthy engine. And the railroad company must furnish safe coaches and all the apparatus and appliances to make the business as safe and convenient and trustworthy as practicable.

But these rules did not adopt the precise stage coach or the van, as they were then known, but the law applies them to the changes of the time. The rules apply to the machinery and vehicles as improvements are made from day to day. So the law does not allow a railroad company, having once equipped its road, to sit down and make no improvements; but as fast as improvements and inventions are made and demonstrated to be practicable, and to add to the comfort and safety of the service, the company is in law and duty

bound to use and apply them; because, being a public road and not allowing other people to furnish their own vehicles, it must furnish as good and as safe as the people themselves could furnish.

That is the principle. Thus, when the air brake was demonstrated to be a safer mechanism than the hand brake, it did not require an act of the Legislature or of Congress to make it incumbent upon the railways to put them on their trains, but the law itself imposed that obligation. So with the vestibule car. Would a railroad be justified in any court now in using the old van and car if an accident happened to a passenger by failure to use the improved vestibule? The court would go back to the old rule and declare the railroad must provide a coach and harness of sufficient strength and properly made. Congress is now compelling air brakes to be put on freight cars to protect the lives and limbs of trainmen.

I have thus attempted to point out the evolution of the railway, mechanically and legally, and I may pause to say that the same is going on in other lines of commerce and business, and that it

is absolutely essential for any one desiring to understand the reason of things in any business or profession to know their origin and development, in order that he may understand the state of things at the present. And when it appears that the railroad is the development of the stage coach upon the public highway, and a freight car of a van engaged in handling and delivering merchandise throughout the county over public roads, it needs no further argument or illustration to elucidate and determine our proposition that a railway, in so far as it relates to the people, is a public road.

And it is quite well, when you come into the railway service, that you should understand the relations which you will sustain to the people. And it is because of the failure on the part of the railway officials, as well as on the part of the people themselves, that there has been so long, and is such, an antipathy between the public and the railroad companies. And when the managers and others controlling our great railway systems

shall intelligently understand that they are operating public roads where everybody has an equal right to go, there will not be in the future, I trust, that conflict between railways and the people that has led to so much dissatisfaction and so much litigation in the past.



VI.

RAILROADS AND THEIR SERVANTS.*

ADDISON C. HARRIS.

WHEN we reflect that there are to-day, in round numbers, a million men in America engaged in the railway service, the importance of the relation of railway companies and their employes is self-apparent.

First, as to the railway companies: It needs no lawyer to say that if I raise a ladder to the roof of my three-story house and hire a man to go on top and perform work, I ought to be careful that I do not send him on a defective ladder.

Now, that principle runs through the whole system of railway law, in relation to the duties of

* Reported by Mr. Evans.

the employer or master to the servant. Put in common form, it is that the master shall not knowingly or carelessly subject the servant to a danger of which he is not aware, and may not protect himself against. Now I shall use the old English terms "master and servant," because they better express the relation, especially in railway service, where there must be a master to command and enforce obedience, else there would be wrecks and disaster all the while; and, further, because he who is engaged in the important lines of railway service must obey.

I shall not go into details particularly. This duty which I have spoken of, upon the company, is a continuing one and rests upon it at all times, and to all its people.

One of the cases which I had early at the bar arose by reason of the explosion of a locomotive while out upon the road, resulting in the death of the fireman. I brought an action against the company for furnishing a defective engine, in that the fire box was old and insecure. The railroad company defended along the line that it had built a

good road, furnished years before a good engine, had a competent superintendent, and a well equipped machine shop, and that this was its whole duty ; and if the servants were hurt thereafter by reason of defective machinery it was not the fault of the company. The jury did not so believe, and gave a verdict against the company.

You may be surprised to hear that the Supreme Court decided the company had performed its whole duty, and remanded the case for a new trial. On the second trial, although the Judge told the jury such was the law, yet the jury—may I say, having a more conscious insistence as to what the right was—refused to follow the instruction and returned a second verdict against the company. Not long after, the Court, and not the jury, changed the law of this State ; and it has now become a settled rule in this and every other State that every railway company must continually do all that it reasonably can, that is fairly practicable, to protect the lives and limbs of its servants.

You have noticed on either side of a railroad

bridge whiplashes attached to a beam across the track, hanging down so as to strike the face of a brakeman on top of the train. This is a means of warning required of the railway to notify its servants of existing danger. Without such notice an injury or death to the servant would be followed by a verdict and judgment against the company.

So, if a bridge is so narrow that an engineer or fireman, swinging out at the cab to look ahead, is struck, the railway is responsible.

So, if a culvert breaks down, or, in general, if anything happens on the line for which a very high degree of care—not extraordinary—would have discovered, and a man is injured or killed, the railway company is liable under the law and must make good the damages as far as can be done.

Upon this principle of protecting the lives and limbs of the servants are those laws which in some States provide that engineers shall be examined as to color blindness, so that they may

not, by mistake, cause a collision, by failing to observe a signal of danger.

Ordinarily, without reflection, we say that this is for the protection of the passengers and freight being carried by the company. It is. But it is likewise security for the trainmen who are behind.

So, if a trainman should be injured by reason of the defective sight of the engineer, it would be negligence as much as by a defective engine, car, and the like.

But the company must do more. You can not take a thousand or five thousand men, give them the railroad machinery and start them in operation unless there are rules carefully framed for the control of the service, and executed with all the summariness, if you please, of the rules governing a regiment or a ship.

So, if a railway company fails to make and enforce practical rules for the handling of its traffic, or having made them, fails to enforce them, and the servant is injured thereby, the company must respond for the injury.

Let us now come to the relation of the servants themselves, because it is fair to assume that in your several careers, many of you will spend your lives in railway service ; for the education which you are acquiring in this University would seem to indicate that by the rule of natural selection, that is where you will fall.

Now, what shall you do ? The first thing, of course, is to do your duty. It must be done promptly, exactly and without murmur.

Some years ago I had a case professionally where it became absolutely essential to know precisely the history of a loaded car from the time it left Dayton, Ohio, until it arrived at Peoria, Illinois, because it was loaded with perishable property which had become valueless during the journey ; and the company which I happened to represent, was sued for not having performed its duty in speeding the car.

I went to the superintendent and asked for a detailed history of the case. The next day he sent me the information in a general way that it left Dayton at one time and three or four days

afterwards it was found at Indianapolis, and some days thereafter it arrived at Peoria. Of course, this was of no avail. I said, "Have you got anybody who can tell me exactly when the car started, when your company received it, when it gave it to the succeeding line, and, in short, all the facts necessary to be known in order to ascertain whether this company has discharged its bounden duty to the owner of the property?"

He replied, "I have a boy in the office who has plenty of time and he might do it."

I told the lad exactly what was needed. He had begun service carrying water on a section; afterwards had been a section hand, and afterwards promoted to a clerkship in the superintendent's office.

Within a short time he came back with what might be called an itineracy of the car for every day and hour of its journey. Of course, I was pleased and said, "If that is the way you do your duty you will be a superintendent yourself some day."

Not more than ten years afterwards I was sit-

ting in my home one evening when the bell rang and a messenger boy brought a letter. All it contained was, "I have got it." He knew how to do, and did do, his duty exactly. That is the practical part rather than the law of it. But let us devote a moment to that question.

You must obey. If you are in the lower lines of duty, it is not yours to reason why, but if an order comes, it is to obey entirely.

It at once arises in the minds of some of you that the railway service, then, is a kind of military employment. So it is. If one goes into a country where the railways are operated as governmental institutions, and, particularly where they are considered as an arm of the military department, as in Germany, Italy or France, you can hardly conceive of a railway servant except as standing in the rank of a soldier; because he is in the governmental, and, practically, in the military service. They wear a governmental uniform.

And so in this country, now, some lines require distinct badges and uniforms; and the very fact that the railway men wear a uniform expresses

the almost unthought concept that in some way the railway service is a public service, like a government service.

Our postal men are required to wear a designated uniform. And the notion as to railways is growing, from the fact that it is coming to be recognized by all, that, in a sense, the railway is a government institution and not a private affair.

Another indication is that the conductors and officers of the trains, by statutes, are made police officers; and if any one violates the law upon a train, or in connection with it, the conductor is clothed with police powers, as a constable, sheriff or policeman, and may arrest or expel the offender without writ or warrant.

A question of interest, now in debate through the press, in legislative bodies, and in political campaigns, in so far as it relates to the status of railway men, is the question of wages; because in that is found the kernel of this question.

Is the railway servant free, entirely, to do as he pleases? Or does he sustain such a relation to the service and the public as that he, in some

measure, surrenders his individual wishes to the wishes and welfare of the greater public?

In the first place the law is always careful to protect wage-earners. It used to be that a railway company could go on and pay out its earnings to the bondholders and others, and put off its pay rolls until it came to bankruptcy, and then turn the property into the hands of a receiver, and leave the employes hungry and remediless.

It does not always take the Legislature to make a good law. The real fact is that more good laws are made outside than inside of the General Assembly. They are made by the courts.

The very case which I have just stated came on in the Circuit Court of the United States at Indianapolis some years ago. A great number—a thousand men—engaged in operating a certain line, had not been paid wages for five or six months. The road was put in receivership; the men appeared at the bar of the court in the person of an eminent lawyer of this State, now dead (Mr. Butler), and presented their claims before that great jurist, Judge Drummond. And what did he

do? He did an act no less courageous and far-sighted than that of the judges to whom I referred in my last address. He made a law that any railroad that came into a federal court in this circuit, composed of the states of Indiana, Illinois and Wisconsin, should, out of the assets of the property, if necessary, pay employes and material men their back wages and demands for the period of six months, before applying the proceeds to the satisfaction of the bonds. It is known as the six months' rule. The hands of some people went up, and a hue and cry went over the land that this was interfering with property rights. And so it was, in a measure. But the rule was sanctioned by other courts throughout the land, and afterwards affirmed by the Supreme Court of the United States; so that now these millions of railway men are, to-day, perfectly secure in their wages by the simple law of Judge Drummond, as first given, and followed and adopted by the courts in the evolution of right. Now no railroad lawyer, or anybody else, denies the justness of the rule.

The rule is regarded as one of necessity, for that roads can not have the best service unless the men feel that their wages are secure. One who doubts whether he is to receive his pay is not that efficient, loyal and courageous man that the service necessarily requires.

Now, this thought of protecting a railway servant in his wages was not a new concept on the part of Judge Drummond. Every well-informed lawyer knows that for thousands of years it has been the law of the sea that every sailor has a lien upon the ship and the cargo for his wages. And so when a sailor enters the service upon a ship for a voyage, he is not free to leave the ship at any port during the voyage. It has always been the law of the sea that if a sailor wrongfully leaves the ship—deserts it, if you please—that the captain has the right, by physical force, to arrest him wherever found, carry him back to the ship, and compel him to continue on the voyage and perform his duties; and, further, if the captain is not sufficient by himself, or his own force, to compel the seaman to return to the

ship, he may call upon the civil authorities, no matter in what port or nation, and they must aid him to put the sailor back on his ship.

It is apparent that maritime business could not be done, cargoes could not be carried around the world, and life would not be safe upon the seas, if, whenever a ship came to a dock, the sailors might desert, and leave it without any one to navigate it to the end of the voyage.

Now, it was this law, taken from the sea and applied to the land, that led Judge Drummond, no doubt, to make the rule which I have mentioned. Is there any difference in principle between a vehicle carrying freight or passengers on water, or on land? It is the same business, and under the same conditions, Judge Drummond applied the same rule.

Now, if this rule be just and true (and the Supreme Court of the United States, by a divided bench, has so held), then may a railway servant, of his own free will, at pleasure leave the train or service? On the one hand it is said that Americans are free men. They have the right to quit

work whenever they want to, in whatsoever service, and no one can prevent it. On the other side, it is said if one enters any branch of the public service, then he must stand to the service and subject his individual wishes to the welfare of the greater public. Over this there is now and has been for some years a struggle which is not yet settled—I can not attempt to settle it, but it may be well to give a little of the history of the question and see how far the evolution has gone. That is as much, perhaps, as we will undertake to-day.

It is sufficient, then, to say that about twenty-five years ago a railroad strike occurred in Indiana over wages, and it so happened that Judge Drummond had more than one railroad in his court, under his receivership and management.

I may pause to say that if some man engaged in private business like a foundry, or dry goods store, finds his property put in receivership, the courts would not carry on his shop or his trade.

But when a railroad is brought into a court, the court always runs the road because it is a public

highway which can not be closed and must be kept in operation for the public use.

This strike involved the men engaged upon the lines under the direction and control of Judge Drummond. They would not continue the service themselves, nor permit others to take their places. Judge Drummond brought his employes and others to the bar of his court, and made the rule that the court would not suffer any person to interfere with the operation of the railway service; but he did not declare that he would not allow as many of the men as desired to quit the service—only he would not permit any person to prevent men from entering the service. There was a good deal of discussion, but finally that has been accepted throughout the country as the proper rule.

You see the precise question whether a railway man has a right to leave the employ of the court or railroad was not then and there involved; but later, and within the recollection of each of you, the question did arise in the railway strike of 1894, or rather boycott, because a strike is where the

men say, "We will not work;" a boycott is where they add, "Neither will we allow any others to work on the road," and thus stop its business.

In 1894 it was attempted to stop the entire railway traffic throughout the country, to force a settlement between the Pullman Company and its employes. Practically all the traffic throughout the country was at a standstill. Merchants and bankers could not send their letters or goods and merchandise; the farmers' freight lay at the stations and on the side tracks; live stock at the yards remained there. It was as if a great earthquake had destroyed the railway commerce of the country.

Now, what was to be done? A thing was done that until that time had never been thought of before. The Attorney-General of the United States, in the name of the United States, filed a bill in the Federal Court at Chicago, stating in substance there were twenty-two railroads doing business through Chicago, and engaged in the business of carrying passengers and freight from

one state to another. These railways were also engaged in carrying the mails and express matter for all the people of the country.

The case showed that this immense traffic was arrested so that no railroad could do business, and that this was brought about by certain persons having control of the boycott.

Upon the bill being filed, the Judges issued an injunction which read something like this :

“We command you and all other persons to desist and refrain from in any way or manner interfering with, hindering, obstructing or stopping any of the business of any of these named railroads as common carriers of passengers or freight between and among any of the states of the Union, or obstructing or stopping any mail train, express train, or other train, whether freight or passenger, engaged in interstate traffic.”

Almost the entire volume of railway traffic in this country has now come to cross state lines in the journey, so as to fall within the protection of the Federal Constitution and laws.

This was an evolution in railway jurisprudence such as had never before been applied.

A court that issues such a writ or command is bound to enforce it, and the enforcement leads to the arrest of the wrongdoer, bringing him to the bar, trying him without a jury, and if found guilty, fining, or sentencing him to imprisonment within the discretion of the court. There is no jury trial.

Mr. Debs and others were brought to the bar of the court, tried and sentenced. They carried the case in a way I need not stop to explain, to the Supreme Court of the United States.

Here, then, was a test that challenged the thought of every man throughout the country, whether he was a professional man or a layman. What power has a state or the United States to keep open these great highways of commerce? Because the United States has no more power over the interstate railroads than the State of Indiana or any other state has over the railways lying and doing business wholly within such state. It is a governmental power—a sovereign power.

And by sovereign I mean a power above which there can be no higher power, and which springs from itself and executes itself.

The Supreme Court of the United States held there was such a power, and held a court did right in issuing the injunction. But this case, you will observe, did not reach to the precise question of the right of the railway man to quit work; the scope and purpose of the case was to restrain the forcible obstruction of these great national highways along which interstate commerce traveled, mails are carried, and the business of the country interchanged and done.

In substance the Court said: "The strong arm of the National Government may be put forth to brush away all obstructions to the freedom of Interstate Commerce or the transportation of the mails. If an emergency arises, the army of the Nation and all its militia are at the service of the Government to compel obedience to the laws."

And in consonance with this last thought, President Cleveland did a thing that never had been

done before, and for which a great number of people have criticised him. What did he do?

Here were these national highways of commerce obstructed so that vehicles could not move; the mails could not be carried and distributed; and he sent the army into Chicago to open the roads. That is all there is of it. He opened the roads by force. To open the roads he put armed soldiers on the locomotives and on the trains, so that they could not be stopped in their movements. He did not send the army to Chicago to put down the mob. Whether he had a right to do so or not is not within the province of this discussion. He had a right to open these national roads—just as much right, and no more, as a road supervisor in any road district in Indiana has a right to open a road if one wrongfully fells a tree across it, or raises a barricade, or tears up a bridge, or refuses to let wagons go by.

So that this much is settled, namely: All the railroads in this country engaged in national business are national roads, and the Nation will see that there is no obstruction put by anybody at

any time upon the movement of the mails or national traffic. And the same is true as to the several states.

There is a notion in the minds of some that there is a difference between a mail car and a passenger car or a freight car. There is none. The freight car that is loaded with interstate freight, the mail car that is loaded with national mails, or the passenger car that has one or more interstate passengers, are alike entitled to national protection, because they are each and all under the jurisdiction and within the protection and control of the United States Government, under that great power of the Constitution which gives to Congress "power to regulate commerce between the states." Each state has the same power over its own commerce.

It thus appears we have not yet reached the precise question, whether a railway man, or a number of railway men, may leave the service at any time at their own will. If they are, in fact, engaged in a public service, like unto soldiers in the army, seamen on a merchantman or sailors in

the navy, or policemen in the municipal service, it is easy to see they can not. It would not be thought that all the police officers in LaFayette, Indianapolis, Chicago or New York, at ro'l-call at night, when there was likely to be a disturbance and melees in the streets, might, willy-nilly, abandon the peace of the city and retire from service, leaving the whole city without protection to lives and property. No more could a city fire force leave the service in face of a conflagration.

But do railway men sustain the same relation as policemen, firemen, soldiers and sailors?

Perhaps that can not be settled until another proposition is put at rest; and that is whether railway men, as between themselves and the companies are in law in the public service. That question did arise two or three years ago, in what is known as the Northern Pacific Railroad case. That road, reaching from the lakes to the Pacific Ocean, and being one of the great national highways, came into the control of the Federal Court in Wisconsin. The men entered into an arrangement or understanding that if their wages were

not made satisfactory to them, then, at a certain time, everywhere between the lakes and the Pacific, they would all leave their trains and service, and the whole railway would thus be blocked. Had they such a right? The Judge presiding in the court issued a writ in the nature of an injunction, in which he said, in substance, that they should not leave the service in a body or singly for the purpose of stopping operations of the road under his administration and control, and declaring, if they did, he would hold it a contempt of his court, and punish them accordingly. The case was removed by appeal into the Federal Court of Appeals, sitting in Chicago, and came on to be heard with Mr. Justice Harlan presiding. He is one of the Supreme Justices of the United States, and delivered the opinion in this case. He denied any such power, and declared: "It would be an invasion of one's natural liberty to compel him to work for or to remain in the *personal* service of another. One who is placed under such constraint is in a condition of involuntary servitude—a condition which the supreme law of the land

declares shall not exist within the United States or any place subject to their jurisdiction."

And he added, in effect, that the fact that the employes of railways might quit under circumstances bringing about inconvenience and injury to the great public would not justify a departure from the well-settled rule that a court would not compel the actual affirmative performance of merely personal service against the will of such servant. It is fair to say this dissented from the decision in regard to sailors mentioned a few minutes since. And so the question rests. It has not been determined by the Supreme Court of the United States.

I have said enough to show that railway law grows by the process of necessity or evolution; and in this country, where questions of this kind are more or less controlled by public discussion and political debate and contention, it can not be affirmed with certainty what form the settlement which must come, will ultimately assume. It is not improbable that in the end, Congress, under the power to regulate national commerce, will pass

laws regulating the question when and how men may enter and withdraw from what I may now call the national railway service. And if so, it necessarily follows that provision must be made for settling and protecting the men in their rights and wages and at the same time, also, protecting the rights of all the people to use the national railways without partiality or favor. And this would seem at the present time to be the consensus of public opinion.

Now, gentlemen, I have done the task which I set before me, and if, in your lives, from time to time, these questions meet you, and you shall happen to find that what I have said may have helped you in the performance of your duties, I will be, I beg to assure you, amply repaid for the little labor I have found it necessary to expend in the preparation of these addresses.



VII.

REMINISCENCES OF A LOCOMOTIVE ENGINEER.

ANGUS SINCLAIR.

[In obedience to a request of the author, this lecture will not appear in published form. It should be said concerning it, however, that the incidents related were drawn from an extensive experience and illustrated with remarkable force many of the conditions attending the early development of railways in our western states. Each story was utilized to give emphasis to some important truth. Indeed, the lecture was made up of fun and philosophy mixed, in proportions which gave to both their maximum value.—ED.]

VIII.

BUSINESS PROBLEMS OF THE MOTIVE POWER DEPARTMENT.

ROBERT QUAYLE.

SIXTY-FIVE years ago railroads were practically unknown. History records their small beginnings with crude equipment. Strange looking locomotives were used that weighed hardly more than a modern dray. The cars were modeled from the stage coaches of that time, and they were run on track of the most flimsy character. The speeds were slow and the service very uncertain, but from this small and crude beginning evolved the world's great systems of rail transportation, which in this country alone aggregate over 184,000 miles of track, and

require in the conduct of its immense business 36,000 locomotives, 34,000 passenger cars and 1,200,000 freight cars, while the capital employed is calculated by hundreds of millions, and the great army of employes by hundreds of thousands. The development of the resources of our country resulting therefrom has been remarkable, and the advancement of civilization not less notable.

It goes without saying that the financial and commercial problems involved in the creation and operation of these great properties—complicated as the situation often was by the fact that railroad construction did not wait the development of the country, but was generally in the lead and opened up the way for it—have become complex in character and of great magnitude.

It is not my purpose, however, to dwell upon the wonderfully rapid growth of our railroads, nor the effect upon the prosperity of our country, nor even upon the business and financial problems arising in the government of these great properties as a whole, but rather to take the situation as

we find it to-day and to give you some insight into a few of the business problems of the motive-power departments of fairly large railroad corporations.

To many of you, who have for several years been studying various branches of engineering and fitting yourselves for battling successfully with the many technical problems that are sure to confront you in the practice of your chosen professions, it may appear as if the technical problems requiring solution by those in charge of motive power, are more numerous, if not more important, than the business problems they are called upon to solve. That this is not the case will be clear upon proper reflection. You have doubtless learned, under the excellent practical instruction you have received at this university, that every engineering question has its commercial and business side; and the importance of always seeing this side and giving it due prominence will be impressed upon you more and more as you add to your experience in the practice of your profession. In fact, every situation or condition of

affairs that requires the services of the engineer calls for the production by him of structures or mechanisms that will not only meet the requirements of the situation but will do it with a minimum expenditure of capital, or will give the greatest returns from the investment. The successful engineer is he whose judgment is so trained that the capital of those who depend upon it will be wisely and safely invested. He must not only answer such questions as, "Can this or that be done?" and "How can it best be done?" but he must give equally reliable answers to such questions as, "Will it pay to do it?" Thus, the rule is that his engineering problems are closely interwoven with considerations of a commercial nature. The conduct of a motive-power department of a large railroad system forms no exception to this rule.

In the earlier days of railroading the duties of General Manager, Superintendent, Master Mechanic, etc., were usually performed by one person, but as the business became more extensive it was found necessary to divide the work among

several men, each with specific duties and responsibilities, and as the business still further increased, the division of the duties became more complete, and the organization was separated into numerous departments, each with a certain designated work to perform, and the work of all to be directed to the welfare of the organization as a whole. The mechanical or motive-power department is one of these several departments in such an organization, and its duties involve the design, construction, maintenance, and operation of the locomotive and the supervision of the men who operate it, except as these men come under the rules and direction of the operating department. The end for which the department was created is of course that of keeping the wheels turning. It must be apparent, however, that as one of the many departments it is necessary to make the work of this one to fit into the needs of the others, and to so conduct its own affairs as to bring them in harmony with the aims and resources of the organization as a whole. This might properly be designated as the grand business problem of

the department. The department is not an isolated organization, but is closely interwoven, in its work and interests, with the operating and other departments, and to successfully carry on its business there is need of a breadth of mind that will clearly discern the relations of the motive power to other departments, and the effect of any given policy within the department upon the work of the others; for a policy that looks all right when viewed only from the standpoint of the single department may be all wrong when considered in its effect upon the organization as a whole. If the carrying out of a certain policy would result in a saving in the mechanical department of \$10,000 per year, but would involve expenditures in other departments of \$10,500, it would not be justified, unless the benefit to the company through the improvement of its service would be worth the \$500 increased expenditure. Thus at the outset we find that what we might call the external relations of the department form a problem that can be solved only by the application of strictly business principles, and we will

see later on that the effect is so far-reaching as to have an influence even on locomotive designs and shop practices. To ignore these facts is to travel in ruts that are constantly narrowing and deepening until the best work of the mechanical department is wholly lost to the company.

Before turning to the problems within the department it may be well to give you some idea of its expenses, from which you can judge of the magnitude of its problems. The average cost of the locomotives may be placed at \$9,000, while the average capital expenditure per locomotive for round houses, shops, tools, etc., is in the neighborhood of \$5,000. Thus each locomotive and the equipment necessary to take care of it represents an approximate expenditure of \$14,000.

The cost of the operation of the locomotive includes the fuel, oil, waste, enginemen's wages, round-house labor, cost of repairs and supplies. The cost of the fuel varies in different localities, being less than one dollar per ton for coal in some eastern districts and more than five dollars in parts of the far west. If, however, we assume

an average of \$1.75 per ton for coal we will not be far out of the way.

We will also assume that an engine runs 26 miles to a ton of coal, and makes 36,000 miles per year; then the cost of fuel per annum will be \$2,423. The wages of the engineer and fireman will average about 6.2 cents per mile, and all round-house labor will average about 1.4 cents per mile, or a total for labor of 7.6 cents per mile, or \$2,736 per year. The oil and waste will cost about .2 cent per mile, or \$72 per year. The repairs and supplies will cost approximately 4 cents per mile, or a total of \$1,440 per year. The cost of water we will estimate at .2 cent per mile, or \$72 per year. We thus find the several items of "cost of operation" to aggregate \$6,743, exclusive of all interest charges on capital employed. It is not unusual for large railroad systems to possess 500 locomotives, and quite a number of them own more than 1,000. From the above figures it will be seen that the operation of 500 locomotives calls for an average expenditure,

through the mechanical department, of \$3,371,500, and for 1,000 engines the sum becomes \$6,743,000 per year. It is, therefore, needless to say that in the expenditure of such large sums as these, and the treatment of a portion of a company's business so important and having such an important bearing on its interests, every problem, no matter what its character, has its business side as distinguished from its narrower or purely technical nature.

Turning now to affairs within the department, we find that there are several important problems in connection with the operation of the locomotive and the service it renders the company. We all look upon the locomotive with a great deal of sentiment, the proof of which is constantly forthcoming in the interest manifested in its performance. Every account of a fast run is read with interest by the general public, as well as by the railroad men, and we are thrilled by the records of great bursts of speed made on the rails. The modern locomotive, with its great boiler and generally massive and powerful appearance, hauling

a passenger train of ten or twelve long, heavy cars at the rate of forty-five or fifty miles per hour, gives an impression of majesty and power not soon forgotten by the observer, who is only far enough away from it to be safe. And as we stand in the depots in some of our large cities and see these trains arrive, at the end of their long and rapid journeys of one thousand miles or more, often on time to the minute, and realize that in daylight and darkness, sunshine or storm, they sweep over great plains, and over or through mountain ranges, sometimes toiling slowly and powerfully up heavy grades only to dash with renewed speed down the mountain sides and into the valleys, that this great burden has been carried such immense distances in safety by machinery that is the creation of man's ingenuity and industry, we feel that it is indeed wonderful. Our great freight locomotives, of slower speed but of much greater weight and power, also engage our attention as we see them coupled to fifty, sixty, or more, loaded cars working heroically to reach their destination on time.

Many students of the steam engine are interested in the performance of the locomotive as a heat motor and peruse carefully the figures for the coal and water consumption obtained by elaborate tests, and are gratified to note the economy obtained as the result of gradual improvement in design. The motive-power official may possess his share of sentiment, and certainly should be alive to all improvements that will increase the economy of the locomotive as a heat engine, but he must also look upon his motive power from a far more business-like standpoint. He must consider the locomotive as a machine—a tool created for a purpose—representing a large investment of capital and costing annually a considerable sum for its operation, and must be deeply concerned in making it give the largest possible return to the company. If to attain this end he must violate, in the construction or operation of the engine, principles which he knows tend toward economy of water and fuel, it is his business to do it. And I have no hesitation in saying that to the carrying out of this wise and business-like policy are due

some features of locomotive practice that are sometimes condemned by those who are apt to look upon the subject entirely from the standpoint of economy in fuel.

Perhaps I can best illustrate this business problem by a comparison which every motive power official has had to make at some time, in connection with the rating of his engines. The tests that have been made upon the locomotive in the testing laboratory of this university demonstrate that the most economical point of cut-off is between one-quarter and one-third of the stroke. Other tests made on this same plant show that as the locomotive boiler is forced and the rate of combustion increased, the rate of evaporation falls off rapidly. The conclusion is therefore warranted that with a given speed a cut-off later than one-third of the stroke will result in a loss of economy, both in the boiler and the cylinders. Are we, therefore, warranted in endeavoring to operate our locomotives under these conditions of maximum fuel economy? The work of the engine varies so much with the grades that we can

not expect to run at a uniform rate of cut-off, but is it economy to endeavor to give the locomotive such a load that it will average one-quarter to one-third cut-off? Let us look into the question. Suppose ours is a nineteen inch engine in freight service on a hilly division and that under a limitation of the average cut-off to one-third, the tonnage which it can haul over the division is six hundred tons, exclusive of its own weight and that of the waycar. Let us further assume that if the engine is worked to its utmost capacity on the ruling grades, even if by so doing we must run it for many miles at from one-half to full stroke, we will be able to haul seven hundred and fifty tons. The train and engine crews' wages will amount to about 13.2 cents per mile or \$13.20 per one hundred miles. When hauling the heavier train we are getting 25 per cent. more tonnage over the division for the same cost in wages, and thereby effecting a saving of \$3.30 for each hundred miles the seven hundred and fifty tons are hauled. This is a clear gain in operating expenses. Now, let us

look at the actual consumption of fuel and in doing this we must bear in mind that while our nominal weights of trains are six hundred, and seven hundred and fifty tons, respectively, the real weights, allowing one hundred tons for the engine and tender and fifteen tons for the waycar, are seven hundred and fifteen, and eight hundred and sixty-five tons, respectively. Evidently the weights of the engine, tender and waycar form a fixed quantity in our calculations and that the heavier the train the less the percentage of the total work of the engine needed to overcome their resistance, and the internal resistance of the engine. Evidently the coal consumption in our comparison should be figured on the basis of the tonnage of the cars and their contents only, for upon this is based the earnings of the train. For the six hundred ton train the coal consumption may be taken at say seventeen pounds of coal per hundred ton-miles, or ten thousand two hundred pounds to haul the train one hundred miles. For the seven hundred and fifty ton train the consumption

per hundred ton-miles will be about one and one-half pounds less, or say fifteen and five-tenths pounds per hundred ton-miles. In other words, the lesser percentage of the total work of the engine expended upon itself, its tender and the way-car, more than offsets the increased consumption of coal per indicated horse power. The total consumption for the seven hundred and fifty tons hauled one hundred miles will be about eleven thousand six hundred and twenty-five pounds. Thus, while the total consumption of coal per trip is of course greater for the heavier train, the consumption per hundred ton-miles is less; consequently the fuel bill to haul three thousand tons of cars and contents will be less if it is taken over the road in four trains of seven hundred and fifty tons instead of five trains of six hundred tons. So we have saved money in both wages and fuel per hundred ton-miles. But the question is broader still. Evidently fewer engines resulting in a lesser investment are required; furthermore, while the cost of repairs per mile run by the engine may be greater, the cost per hundred ton-miles of train

hauled will be less. Again, the fewer engines will mean a smaller investment in round houses, shops, machinery, etc., and last, but not least, the operating expenses will be reduced in more ways than train crew wages, and the liability of accident will be lessened by the fewer number of trains. Thus the broader the light in which this question is viewed the greater the economy of working the locomotive beyond the point of maximum economy per indicated horse power.

That this view of this business problem is correct will be acceded to by every motive-power official. The situation may appear to you to be paradoxical, particularly in regard to the item of fuel, but that coal can be saved by loading an engine heavily we have proof of daily. The road with which the writer is connected keeps an individual coal record by which the consumption of coal per hundred ton-miles by each engineer is recorded. In a group of men in comparable freight service on one division the best performance in November last was fifteen and nine-tenths pounds per hundred ton-miles, the engineer having an average

train of eight hundred and fifty-three tons. The poorest record was twenty-eight and seven-tenths pounds, but the average train was only three hundred and seventy-eight tons. Of course there are differences in engines, which was true in this case, but all our coal accounts support the statement that, other things being equal, the heavier the train the less the consumption per hundred ton-miles. The limit to this rule is not reached before the engine is so overloaded that the required time can not be made. So evident is this to our engineers that they are anxious to haul the heaviest trains of which their engines are capable, as by this means only will their records compare favorably with others in the same class of work.

This same mode of reasoning, by which the work of the engine is viewed by its effect upon the net cost of hauling tonnage rather than its economy in fuel per horse power, must apply to other questions involved in locomotive construction and operation. On this basis the size of locomotives have been constantly increasing and

will continue to increase. Anything which adds to the economy of performance, but limits the amount of work that can be obtained from the engine, either by reducing the tonnage it can haul per trip or reducing the mileage it can make per year, can not hope to succeed. If a complicated valve gear would save five or ten per cent. in fuel, but would cause the engine to miss a trip occasionally because of repairs necessary to the mechanism, the loss of the service of the engine to the company in busy seasons would possibly more than offset the saving in fuel. On the other hand, simple, strong and reliable construction of the locomotive, facilities for quickly repairing it, and everything that will add to its useful mileage per year, is worthy of careful study. At the same time the necessity of meeting these conditions does not relieve the motive power official of getting the greatest possible economy out of the locomotive as an engine, after he has met the conditions noted, and if he does his whole duty he will be eager enough, in his attempt to

obtain this economy, to satisfy the most enthusiastic student of the steam engine.

In connection with the shops and the work done in them there are numerous business problems. It is not given to every superintendent of motive power to locate and build up a great plant that shall meet the company's needs. But when such a plant is to be built, the same business considerations obtain as in the creation of a manufacturing establishment. Most of us, however, find on the roads we serve a more or less complete equipment of round houses and shops, with which we must do the best we can. Oftentimes these shops, in their location, size and character of their buildings, are far from being perfect, not necessarily because some one blundered when they were built, but because no one could foresee the extent of the growth of the company's business and the extension of its track and equipment. Furthermore, as most of our large railroad systems have reached their present size by the consolidation and absorption of smaller lines, each of which, when independent, had shops of its own, it is not

surprising to find a system provided with many shops, more or less completely equipped for doing the work of general repairs, and yet not one of them with all the facilities for doing work cheaply and on a large scale. This situation presents another business problem. The round houses, also, may have been originally located with reference to the needs of the short lines now consolidated into the larger system, and with the practice of having our locomotive runs average but little more than one hundred miles, which prevailed until recent years, these houses may all be in use. Again, we have a business problem before us. Every such point involves certain expenditures for superintendence, etc., and the smaller the number of locomotives handled at a given point the higher the ratio of these expenditures to the total outlay. Then the cost of dispatching and round-house labor is not dependent upon the length of the run the locomotive has made, but is as great for a trip of one hundred miles as it is for two hundred miles. Consequently, where division terminals can be so

changed as to give the locomotives longer runs, round houses can be closed, resulting in a considerable reduction in the amount of labor required to handle locomotives at terminals, as well as a material reduction in the cost of the labor remaining to be done in the houses retained. Another advantage gained is the greater mileage that can be obtained from locomotives when the runs are lengthened.

If we find the number and equipment of the shops to be as already indicated, a change will be necessary, if the cost of repairs is to be reduced to a minimum. You will remember that we assumed the repairs would cost four cents per mile. That amounts to \$1,440 per locomotive per annum, or \$1,440,000 per 1,000 locomotives. If we can reduce the figure by one-half cent per mile, the cost per annum will be reduced by \$180,000. To effect such a reduction we must have improved machinery and up-to-date methods. But much of this machinery, if installed in a small shop, would be idle most of the time—so

much of the time that it might not pay to purchase it unless more work can be found for it. To illustrate: Suppose a railroad finds it has no boiler shop that is properly equipped for economical work; at one of its main shops it takes out antiquated machinery, such as old punches and shears, single-spindle post-drills, bending rolls, operated by hand, etc., and in the place of this machinery is installed a powerful punch with throat deep enough to permit reaching the center of the widest sheet to be operated upon, a modern shear, an hydraulic riveting machine with at least a twelve-foot gap, multiple-spindle drills, power bending rolls, an hydraulic flanging machine, and other modern machinery, including traveling cranes. All hand work is now reduced to a minimum, and the shop is prepared to do the best of boiler work with great economy over the old methods. When this is accomplished it will be found that the shop is capable of doing a much larger amount of work than formerly; in fact it can probably do the heavy boiler work for 800 locomotives, even if in its equipment there was

installed only one of each of the more important tools. It will not pay to improve every boiler shop on the road in this manner, nor will it be necessary. By concentrating the heavy boiler work at a few places the maximum of economy can be obtained and with the minimum capital invested in tools. And so we might go through the blacksmith shop, machine shop and other shops and find many similar cases where the introduction of improved machinery and methods must go hand-in-hand with a concentration of the class or classes of work affected thereby.

Now nothing is more certain than the need of modern methods and first-class machinery in railroad shops; from which it follows that concentration of work must be accomplished, at least to the extent of keeping properly employed this modern machinery. This leads us to turn our attention to the small shops on the various divisions, with a view of deciding how much of the work performed in them can be profitably transferred to the larger and better equipped shops.

We may find that with proper round-house facilities for making the running repairs, some of them can be closed entirely. In such cases we gain not only the benefit of a lower cost on the work thus transferred to a better equipped shop, but we save in such items as light, heat, power, superintendence, etc. As superintendence itself is a large item—amounting to about ten per cent. of the total expenses of the department—the saving in this direction is not inconsiderable. There will still remain, however, numerous shops that must be maintained, and in which certain classes of repairs can be as cheaply done as in the main shops. It will be found economical, nevertheless, to take from them the heaviest classes of repair work, and also to relieve them of the manufacturing of much of the standard materials.

Perhaps I have used the word manufacturing unadvisedly, for if each outside shop is allowed to furnish all the new parts necessary in the course of its repair work there will be little manufacturing done. When a locomotive is overhauled, such parts as driving boxes, shoes and wedges,

rods, crank pins, cross-heads, etc., need more or less work done upon them to take up the wear, and evidently such work never can be put upon a manufacturing basis. Here and there a new crosshead, crank pin, driving box or other part is needed, but in many shops the number required at any one time is too small to introduce the labor-saving methods that would be possible if they were made in quantity. Evidently, however, if the main shop undertook to supply these parts in a finished condition to all the outlying shops, they could be made in such quantities as to greatly reduce their cost. This, I believe, is what should be done, and to a larger extent than is usually practiced. The main shops should undertake to make on a large scale as many of the new parts required in repairs over the system as the conditions will admit of, and this work should be done upon a manufacturing basis so far as practicable. By this means the cost is reduced and there is every incentive to keep on cheapening the work and raising the quality of it by special

and ingenious methods, by templates, jigs, special cutters and other tools.

To carry out this policy, two things are necessary: A standardizing of the parts of the various locomotives owned by the company, and liberal appropriations for the machinery needed in the work. The appropriations are matters which must be settled by the management. Without them these economies can not be effected and it is a matter of regret at times that there is not more money forthcoming for these purposes. But we will assume that this matter has been satisfactorily disposed of and consider for a moment the work of standardizing.

When you stop to think of the rapid changes that have taken place in locomotive design in the last ten years, by which steam pressures have been increased about fifty pounds and the size and weight of locomotives greatly augmented, you will readily understand that railroad companies which have purchased many engines in that time have a variety of designs in service. The consolidation of companies has in some cases

added to the variety of equipment under the care of the motive-power department. To manufacture parts for these engines it is necessary to use the same patterns and sizes on as many engines as possible. By so doing the quantity of stock required to be kept on hand will be less—a most important consideration. To show you the need that may exist for standardizing and what can be accomplished I will quote you a few of the results obtained along this line in the motive-power department with which I am connected.

We have reduced to one or two sizes most of our cocks and valves, oil cups, injector checks, glands and all other brass work and small parts. At one time we had 113 different kinds of cabs on the 1,010 engines owned by the company; now their number has been reduced to nine. Pilots at one time were built of fifteen different heights; now there are but three. The number of kinds and sizes of smoke stacks have been reduced from legion to four. Two patterns of exhaust pipes have replaced forty-five old ones. Ten cross-head patterns take the place of twenty formerly

used. Three standard eccentrics take the place of eleven needed heretofore. Sixteen cylinder head casings and seven cylinder head patterns have been discarded; also, six steam chests and casings. Six standard wheel centers now take the place of twenty-two formerly used. And so I might go through the entire list, but those already mentioned are enough to indicate the great saving that can be accomplished both in the stocks carried and the cost of production. Not a week passes without seeing more of this work accomplished; and yet, in it all, one must be constantly on the alert for improvements and must not hold these standards too sacred. They have to be discarded occasionally if we are to profit by our own experience and that of others. But with both large and small parts properly standardized and special tools and methods introduced, practically all the small standard parts can be manufactured at one shop and many of the large parts can be produced in the same way.

Some roads do nothing but repair work in their shops, but a few undertake to build quite a number

of their own engines. Rebuilding of locomotives is carried on to some extent in nearly every railroad shop. Where to draw the line in rebuilding it is difficult to determine. By this term I do not mean the making of extensive repairs and yet retaining the original design. Most roads find themselves possessed of engines of moderate size, provided with boilers much too small for the cylinders, and carrying a low steam pressure. If these engines were rebuilt and given new boilers the tractive weight and power would be largely increased by the larger boiler and higher steam pressure. Whether it is advisable to do this depends upon the service the rebuilt engines are intended for. Perhaps I can best illustrate the manner in which this matter should be viewed by taking actual cases. A road needs for its passenger service an engine, the equivalent in power of a seventeen inch engine carrying 180 pounds of steam. Its modern power is all large and the seventeen and eighteen inch engines owned by it will not do the work because the boilers are too small and they only carry 140 to 150 pounds steam

pressure. To rebuild one of these seventeen inch engines, giving it a new boiler, will cost, say four thousand five hundred dollars. I believe it will pay to do it, if the machinery is heavy enough for the higher pressure, as a new engine for the service required will cost about eight thousand dollars. We save not only the difference in the cost, but we have one less small engine on our hands. But suppose we expect to use these rebuilt engines in freight service and have no particular place for them, but only contemplate increasing their capacity by the rebuilding, we would gain about twenty per cent. in power by the change. If the tractive power of the old engine be expressed by the number 100, then three engines rebuilt would have a total tractive power of 360. The cost of rebuilding the three engines would be thirteen thousand five hundred dollars. Now if we leave the old engines as they are and spend eleven thousand five hundred dollars of this money in purchasing a heavy modern freight engine we will be able to get one with a tractive power represented by 175, and

we would then have four engines, three old and one new, with a combined tractive power represented by 475, or an average of 118.75 per engine. If we should scrap one of the seventeen inch engines we would have three engines with a tractive power of 375, or an average of 125. Thus we find that for two thousand dollars less money we can, by purchasing new power and keeping all our old power, get almost exactly the same average tractive power as by rebuilding, and that if we would scrap one old engine for each new one purchased the average tractive power of our engines would be considerably increased over what we could obtain by rebuilding. Evidently the figures are against rebuilding except where the rebuilt engines will fit into some particular place, generally in passenger service.

I have shown you enough of the work of the motive-power department to make it evident that to successfully carry on a business as large as we have been considering, a complete and thorough organization is necessary. The peculiar character of the work, involving shop management

on the one hand and the control of a large body of men and the movement of many locomotives on the other, maintenance of the locomotives already owned and the designing of new ones, and the necessity of carrying on some of this work at points widely separated from each other, are all arguments against the possibility of any one man giving the details of this work his personal supervision. And to trust these details to others, a unity of purpose and practice is required. The business at each point must be conducted as a part of the great whole and not on independent lines. Improved methods or designs worked out at one point should become the practice at all others, if capable of more than a local application; in this manner only can advantage be taken of the ability and ingenuity of those in charge at each and every point. Without this unity, standards would soon be disregarded and would be of little value because they would not be based upon the experience of the whole department. A successful organization must not only assign to each person in it certain responsibilities and duties, but

it must be of such a character as to utilize the best work of each one. By giving to all as much of a voice in shaping the policies of the department as is consistent with the responsibility which must rest with the head of the department, I believe the best results will be obtained. If the men in charge at the various offices of a large department are asked to carry out instructions issued from headquarters without being consulted as to the effect of such instructions upon their work, the faithfulness with which they may carry out orders will never compensate for the loss to the department of the judgment and experience of these men, and the free expression of opinion which should prevail. Without attempting to lead you into the details of organization, I can assure you that, after the selection of capable men to fill the various positions of responsibility, an organization that will call out the hearty co-operation of each and every one of them is essential to the success of the work.

Co-operation, however, should not be confined to those in official positions. The further this

spirit of co-operation can extend into the rank and file of the department, the better it is for the company, its officers and the men themselves. This desirable result can be brought about by honest, fair dealing toward the men by those in authority over them. There is a wonderful amount of loyalty on the part of the men towards a great railway corporation that always endeavors to treat them justly, and fortunate is the company that wins that loyalty. Its value can not be computed. Many corporations, and many officials possess it, and they have won it without yielding any of their own rights to the men, but simply by according them justice at all times. We need to bear in mind constantly that our employes are men and that a large percentage of them are manly men and should be treated as such. With this thought directing our dealings with them we cherish those much-to-be-desired relations between employer and employe, that conserve the interests of both.

Statistics are usually so uninteresting that I have made but little use of them this evening.

Properly kept they are, however, of great value. By their use the business of the department can be grasped in its entirety. But in order that they should not mislead, they must not only be accurate, but must be on the right basis. In the past nearly all of the statistical work of the department has been computed on the engine-mile basis. In many respects this is most undesirable, as the engine-mile is far from being a constant unit. The ton-mile is a much better basis for much of our statistical work. Already we have placed all our coal records on this basis, and it is probably only a question of time when repairs and supplies will be computed in like manner. The importance of this matter is nicely illustrated in our coal records. On the engine-mile basis the engineer who hauled the lightest train made the finest showing, other things being equal. On the ton-mile basis the man who hauls the heaviest train may expect to have the best record. Thus we furnish an incentive to actual economy of operation, instead of putting a premium on extravagance. Furthermore, you can readily see that if

we had not considered the ton-miles we would not have seen any economy in fuel in our 750-ton train, as compared with a 600-ton train, in our example of engine-rating. The value of the ton-mile statistics are also illustrated by the records heavy modern power is making on many roads. When these engines are first put in service the men find they burn a large amount of coal per mile run, and use more oil than the smaller engines. Computing their fuel supplies and repairs on the ton-mile basis, however, the performance is seen to be a wonderful improvement over the smaller engines, and fully justifies their use on divisions whose business is heavy enough to properly utilize them. It will be clear upon reflection that the statistics on the ton-mile basis would determine the true cost for a unit of work ; and furthermore, as this unit is also a fairly accurate measure of the value of the service rendered the company, we are able at all times to determine with a fair degree of accuracy the cost of the locomotive performance per unit of revenue-producing service.

In my address to you this evening I have endeavored to keep within the limits of the subject assigned to me, and have avoided as much as possible the discussion of technical matters. The business problems of the motive power department are so numerous, however, that it would have been impossible in the time at my disposal to have touched even lightly upon them all. I have preferred, therefore, to take up only a few that confront us, with the hope that they would demonstrate how essential is the proper solution of such problems to the success of the work of the department. These problems are not new, and in the near future some of them may cease to exist, their place being taken by others, brought about by new conditions and the rapid progress being made in economic railroad operation. The tendency of passenger and freight rates is steadily downward, and that the railroads may live on the reduced rates the cost of operation must decrease likewise. The motive-power department must contribute its share to the reduction of expenses, and must do it by giving careful attention to its business problems.

IX.

EXPERIENCES IN THE MOTIVE- POWER DEPARTMENTS OF RAILWAYS.

GODFREY W. RHODES.

[Not many superintendents of motive-power have enjoyed a wider experience than has Mr. Rhodes, and few have observed more carefully. His lecture, while dealing with incidents, was full of valuable suggestion.

He discussed the fundamental principles which apply in the management of men, and urged the value of pains-taking and considerate attention on the part of heads of departments, sketching briefly some of his personal experiences and leading his audience to a broad view of the responsibilities resting upon those who are called to direct the work of others. The dependence of practice upon the application of correct principles was emphasized and the necessity for conducting experimental investigations under conditions of actual service was presented in a most forceful and attractive manner.

The value of experimental research was illustrated by a brief account of the Burlington Brake Tests, but the modesty with which the speaker referred to the difficulties encountered, and to the far-reaching effect of the results obtained, aroused but slight suspicion in the minds of the student audience that he was the masterful leader in that great work.

In deference to the urgent desire of the author, this lecture will not appear in published form.—ED.]

X.

RAILWAY SIGNALING.

FREDERIC A. DELANO.

THIS subject, as you can readily understand, is a pretty broad one, but in its use in connection with railway operation, it is restricted to a comparatively narrow field. In railway operation, signals may be classified as follows:

1. Fixed signals designed to protect railway crossings, turn-outs, cross-overs, switches and the like, such as semaphores and switch targets.
2. Fixed signals to space trains, called block signals.
3. Fixed signals designed to stop trains for train orders.
4. Audible signals, such, for example, as whistle signals, torpedoes, etc.
5. Hand and lantern signals used by train and yard men in handling trains, or in switching cars.
6. Bell or whistle cord signals used by train men in passenger train service only.

Our time this afternoon will be confined entirely to the consideration of fixed signals, and by the term fixed signals we must not get confused with stationary signs and posts. It has not been uncommon for writers on this subject to call mile posts, whistling posts, stationary road crossing signs, and slow boards, fixed signals. In point of fact, these are stationary signs, and can not be considered signals, all definitions in the dictionary to the contrary, notwithstanding.

To my mind a signal must, in the nature of things, be capable of two or more interpretations, in the most simple form a positive and negative one, and under this conception of a signal all stationary signs, which can only be susceptible of one interpretation, would be excluded from the term signal. On the other hand a fixed signal is so named to distinguish it from a movable signal, such as hand or lantern signals, or from audible signals, such as whistle or bell signals. By a fixed signal we mean that there is a stationary staff or mast at which the various indications are displayed, be these two or more.

When fixed signals were first employed on railways, the important thought was to make the cautionary or danger indications prominent. The reverse or opposite indication of the signal was considered unimportant; thus, the earliest form of signal to indicate the position of switches was the old target, a simple revolving disk, which showed the entire face of the disk when the switch was thrown for the side track and against the through line, but simply the edge of the disk when the switch was thrown in the reverse position or with the through line clear. In the same way the earliest form of semaphore, when in the "all-clear" position, disappeared behind the post on which it was mounted, or, in some cases, into a case or box, thus completely hiding it from view.

It has only been in recent years, say twenty-five years in this country and somewhat longer in England, that the principle has become generally established, that it is quite as important to show a definite unmistakable indication for each interpretation of the signal. In other words, it is

as important for the locomotive engineer to know that the line is all-clear, as it is to know that the road is blocked, and the rule has been generally adopted that the absence of a clear signal must be interpreted as a danger signal; also, that the normal position of all signals is at danger, and any failure of parts allows the signal to go to danger.

The fixed signal may be classified under two general types: First, the semaphore signal; and second, the disk signal. The semaphore signal seems first to have been described by the Greek author Polybius, but came into use in modern times toward the end of the last century, when it was proved to be the signal best suited to be seen at long distances. The signal was simply a hinged or pivoted board projecting from an upright mast. It was found by experiment that a signal made in this way could be seen against the sky for very long distances, and that various indications could be made by changing the position or angle of the board relative to the mast. It was first introduced in France about the time of the



French Revolution for conveying messages between distant signal towers, and the name of the engineer who first introduced the system was Claude Chappé. He was made Engineer of Telegraphic Lines in France. Subsequently the semaphore signal came into use in marine service, and later, on railways.

Under the general type of disk signals there may be included all forms of revolving signals and swiveling or otherwise disappearing shutters, within a fixed frame. Both these types of signals, *i. e.*, the semaphore and the disk signal, are effective only in daylight, and must be supplemented by lamps and colored lenses at night. Thus while by daylight we differentiate fixed signals into two main divisions, we must make our night signals all of one general type; for while ingenious devices have been suggested and successfully operated to make an illuminated semaphore blade, the best practice to-day returns to the lamp and colored lenses.

The technique of signaling, and the various appliances which go with it, is too elaborate and

complex to consider fully in this lecture. The system, as we find it to-day, is an evolution, and every inch of the way of progress has been fought over; every part has been added or altered to fit a want, either actual or supposed. Ingenuity has constantly been creating new devices, many of which have later been discarded. Not a few of the difficulties in relation to the use of signals are those incident to the severe climatic conditions prevalent in England and in this country. To understand the subject we must consider it in approximately the order of its development.

Semaphore signals came into general use first in Great Britain, and, in fact, on account of the density of traffic and governmental requirements, reached quite a high state of development before the art of signaling was much considered in this country. In England, as grade railway crossings were rare and stations with sidings and turn-outs numerous, the first necessity of signals was to protect trains in the use of these sidings and turn-outs, and indicate to the locomotive drivers the position of the switches.

As I have said before, the first form of signal or indication at a switch was the target or revolving switch stand, used in an improved form to this day; but as speed increased it soon became evident that locomotive drivers must be forewarned of the position of the switches by a signal that could be seen at considerable distances. This led to the introduction of the semaphore signal near the switch, and when the alignment of the track precluded the possibility of seeing these signals at considerable distances, an additional signal repeating the position of the signal near the switch was put in advance further up the line.*

* At first these semaphore signals near the switch or the repeating signals in advance were thrown independently of the switch, and the employees were trusted to follow prescribed rules as to throwing these signals first, and before throwing the switch, but it was soon found that this was putting too much dependence on humanity, and a simple mechanism was devised by which the signal was locked or slotted with the switch in such a way that before the switch could be moved the signal must first be placed at danger, its normal position, and after the switch was thrown the proper signal again cleared. Thus we see that the interlocking system began in England with the locking of a single switch with the signal which governed it. This developed into the locking of several switches with a single semaphore, and finally of making a certain succession of movements on any desired route or line of movement, dependent upon certain other successive movements for some other route, with a view of making it impossible for an operator to give clear signals for conflicting routes. And whereas, the earliest interlocking machine was out of doors, or as we now say, "in the field," with perhaps two levers, one to throw the signal and the other to throw the switch, the highly developed machine of to-day is in a central tower containing perhaps one hundred or more levers, some operating signals, some operating locks, and some operating switches.

This, then, was the first use of what became and are still known as "home" and "distant" signals. As important stations became equipped with these safeguards the increase in traffic created the further necessity of spacing trains, which was, of course, especially important in England on account of fogs, and subsequently these signals at stations, when connected, station to station, by electric telegraph, came to be used to space trains. This was the embryo block system, beginning by spacing trains on a time interval, and developed gradually into the discarding of the time interval block, and the adoption of what is usually spoken of as the "absolute block."

Under the theory of absolute block no train could start from any station, until the next train ahead of it had cleared the station next in advance. This met with objections, in that it delayed traffic. Two courses remained open; one was to allow more than one train to pass into the block, or space, and this was done by using a distinctive signal to indicate that there was already a train in the block. The other course, which,

because it meant considerable additional expense, did not come in at once, has since come into more and more general use, displacing the first, namely, dividing the space by putting in signals and cabins at which they could be operated, intermediate between the former stations. This plan has preserved the good features of the absolute block, and, according as the space or blocks have been shortened, has increased the traffic capacity of the line to the theoretical limit.

The block system, as developed up to that point, was perfect so far as it went. If the rules were obeyed, trains on a double track line were spaced with absolute safety, but this "if" was found to be a very important one, for it meant that a great deal of dependence was put on the human frailty of the operators in the towers (variously called cabins or boxes, and in this country, towers or cabins).

Ingenuity again set to work to overcome this difficulty, and the development has been along the following lines: First, there has been an effort to simplify the intercommunication between

towers, and, whether using the electric telegraph, or a bell signal electrically transmitted over a wire, the effort has been to prescribe a very simple kind of a signal, and to prescribe the method to be followed with such precision that operators become accustomed to a regular procedure, and follow it like automatons. The second notable improvement has been in making one operator a check on another, and by a combination of electrical and mechanical means, interlocking one operator with another, so that it is impossible for one operator to give a "clear" signal until the next operator has given his consent, and "released" him. The third, and by far the most advanced stage of the development, has been to make the operation of the signals entirely automatic. Advancement along the first and second line has been notable in England, whereas the last development of the automatic block signal has been confined entirely to this country.

To return to the development of signaling in the United States, it is important to bear in mind that owing to the very different necessities in this

country, it has been in a way entirely different from that in England. What had been done in this country prior to 1874 need hardly be considered, except in respect to the "train-order" signal, which need not be especially described here. Whatever advance had been made prior to 1874, was practically discarded, and superseded by the English system which began to be introduced here at that time. In this country, however, the first necessity for signals was to protect the crossing of one railroad with another at the same grade, and the first modern signal plant introduced, was the Saxby & Farmer interlocking machine, put in by the Pennsylvania Road at East Newark Junction, in 1874. This machine is now a permanent exhibit in the Field Columbian Museum in Chicago. Following closely on this was a necessity for a block system on lines of heavy traffic. It will be seen, therefore, that while in England, signals at stations interlocked with switches and cross-overs, came first, and that successive stations equipped with signals became, subsequently, a block system with

intermediate blocks added as the necessity arose ; in this country the necessities developed a sort of double system not co-ordinate : First, signals to protect occasional crossings of railroads at grade, and, second, a block system independent of switches and turn-outs, to space trains and prevent rear-end collisions. In England, in the nature of things, no block system could grow up independent of the signals interlocked with switches, turn-outs, and cross-overs, but in America there has grown up a block system side by side with an interlocking system, and many of our railroad men to-day, and among them, able signal engineers, treat the two systems as separate and distinct, urging the use of a different form of signal for the interlocked signal, than for the signal which is simply designed to space trains.

To the man up a tree, this distinction is objectionable and certain to lead to great confusion sooner or later. To him it seems that as necessity grows, all our switches and cross-overs on the main lines, as well as junctions and crossings,

must be protected by signals completely interlocked with each other. At the same time, as the block system grows, one will soon overlay the other, and become very confusing. To come nearer to earth, the man running the engine recognizes primarily only one of two meanings in signals, whether they be of one form or another ; to him they must mean either that it is safe for him to go ahead, or that he must stop. He must know this as distinctively as possible, and in as few words. A circumstance that has added to the confusion is that while the semaphore signal has always been retained as the best signal for our interlocking plants, it has been found that some form of disk signal, incased in a weather-proof frame, could be more conveniently and economically operated in an automatic block system. This confusion bids fair to find an early solution in the general selection of the semaphore as the proper type of signal, whether it be interlocked with switches at stations and junctions, or whether it be simply a block signal, operated manually or automatically, for there is no denying that the

semaphore is the preferable type of signal. Until this time shall have been reached, however, we shall have on some of our railroads three styles of fixed signals, differing slightly by day, and intended to convey slightly different shades of meaning to the engineer running the train, but at night not differing at all. These three styles of fixed signals are: First, the interlocked signal, which tells the engineer whether he must stop, or whether he may proceed, and, if he may proceed, by which route he is to be sent; second, the block signal, which tells the engineer he must stop or go ahead, because the road is blocked or clear ahead of him; and third, the train-order signal, which tells the engineer to stop if there is a train-order for him, or to go ahead if there is none.

Great as has been the development in signalling in recent years, what is needed now is a rationalizing of many of the inconsistencies which now exist, and a simplifying of the indications of the signals, and of the signals themselves as much as possible. The importance of this statement can best be appreciated by those who

frequently ride in a locomotive cab, not by sitting at the office desk. An engineer on an engine hauling a train at the rate of 60 miles an hour advances at the rate of 88 feet per second, and a signal must mean something decisive to him, immediately. One of the greatest arguments against the differentiation in the style of signals made in daylight signals is that no similar differentiation can be made in the night signals, and at best there is confusion in night signals arising from the multiplicity of signal lights at switch-targets, on trains, in neighboring buildings, and elsewhere, all of which add very much to the possibilities of confusion. The remedy for this is to diminish unnecessary signals as much as possible, and I am inclined to think that much more can be done in this direction than has ever yet been done.

DESCRIPTION OF SIGNALS.

The home or stop signal, when made of the semaphore type, consists of a board with a square or straight end, painted red, with a white stripe

on the face, and white with a black band on the back. (See illustration.) It is so mounted that it always points to the right of the mast on which it is located, and the mast is placed on the right-hand side of the track it governs, to an observer, facing in the direction of the train movement. When it is not possible, as sometimes occurs, to place the mast of the signal on the right-hand side next to the track it governs, the mast is sometimes placed on a bridge or on a branched or bracketed post. By night the home signal, under the practice that is practically universal in this country, shows a white light when it is "pulled off" or at all-clear, and a red light when it is displayed at danger or stop. This signal always means primarily the same thing, whether it is used as a signal interlocked with the switch or whether it is used as a block signal or train-order signal; that is to say, it always means stop or go-ahead. The secondary meaning in each case may be different, but the primary meaning is certainly the all-important one. It will readily be seen that the term home signal, although it has come into

such general use that it can hardly be discarded, is nearly a misnomer when the general use of this signal is considered. It was well named home signal when it was the signal close to the switch point which it was intended to govern, and close to the tower, cabin or station from which it was operated. It seems improperly named a home signal when it is used as a block signal or a station signal far beyond a station, or in advance, to protect a train which is stopping at the station.

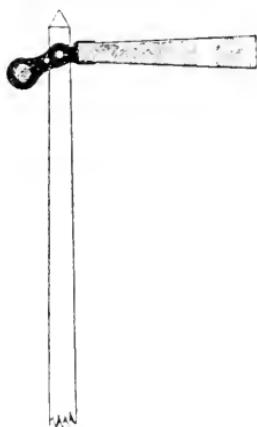


FIG. 1.

Home Semaphore Signal.
(Horizontal, meaning stop.)

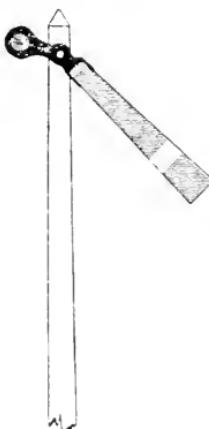


FIG. 2.

Home Semaphore Signal.
(Pulled down, meaning proceed.)

This semaphore or pivoted board displayed horizontally means stop ; pulled to clear—or, as they say in England, “pulled off”—not, as formerly, so that it disappears behind the post, but as is now the usual practice, pulled so that it drops to an acute angle with the post or mast, or, as is the practice of some roads, to a vertical position parallel to the mast, it means proceed, or all-clear. Some roads make this same semaphore give an intermediate indication between the stop position and the all-clear position to mean proceed with caution. At junctions, or where there are one or more lines of track opening into several, it has become necessary to use this same semaphore signal to indicate not only to stop and to go-ahead, but, if it is safe to go-ahead, by which route the train is to proceed. The first plan of doing this was to put as many semaphore blades on the mast as there were routes. The top blade was intended to indicate whether the right-hand route was clear or blocked ; the second, whether the next route to the left was clear or blocked, and so on. This soon lead to great confusion, and was

discarded in this country, although it is still in use in England, where I have seen semaphore posts with as many as six or ten blades on a single mast. In this country a comparatively simple rule has been adopted: That the number of signals on any mast is limited to two, the top blade to indicate whether the main or superior route is clear

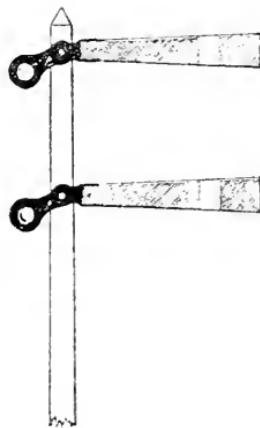


FIG. 3.

Two-arm Home Semaphore Signal.

or not, and the lower blade to indicate whether the engineer must stop, or whether he may proceed by any other route. In other words, this plan contemplates that the lower blade governs

the procedure of the train on all other than the superior route, whether the inferior routes number one or a dozen. In some quarters the objection has been made that where one line divides into two lines of practically equal importance, and into less important routes besides, it is impossible for the engineer to judge, when he gets a signal

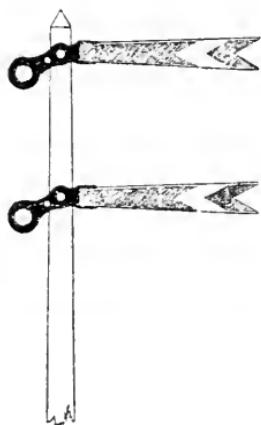


FIG. 4.

Two-arm Distant Semaphore Signal.

to proceed by the inferior route, whether he is to be sent by a high-speed route or into a yard siding. To overcome this objection, two distant signals are placed sufficiently in advance of the

home signals to repeat the positions of the home signals, and the top distant signal operates with the top home signal, showing whether the superior route is clear or not, while the bottom distant signal works with the bottom home signal, and is cleared only when the bottom signal is cleared for the second important or high-speed route, but can not be cleared when the bottom home signal is cleared for any unimportant route.

When the home signal is made of the disk signal type, the disk or swiveling shutter shows transparent or white when the signal is clear, and red when the signal is at danger or stop.

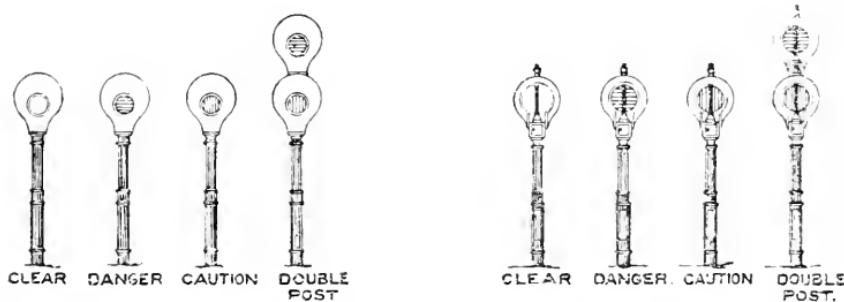


FIG. 5.

Some of the many forms of Disk Signals used in Block Signaling.

A distant signal when made of the semaphore type, is very similar to the home signal, but with a fork or fish-tail end, and painted green with a forked white stripe on the face, and white with a black band on the back. Although the usual practice to paint the face of the home semaphore signal red, and the face of the distant semaphore signal green, the form of the signal and not the color is of prime importance, and some companies paint the face of both home and distant signal a lemon yellow color. By night the distant signal, by the usual practice followed in this country, shows a white light when it is pulled off, or clear, and a green light when it is horizontally displayed to show that the home signal, whose position it repeats, is displayed at danger or stop.

Distant signals of the disk signal type when used, have a disk or swiveling shutter, displaying a green disk or shutter when the home signal in advance is at stop, and the white or transparent disk or shutter, when the home signal in advance is clear.

The distant signal, or a signal of precisely the same description, is not infrequently known by railway men as a "cautionary signal." This arises from the use of signals in a permissive block system, that is, where more than one train is allowed in a block, and where the signal simply

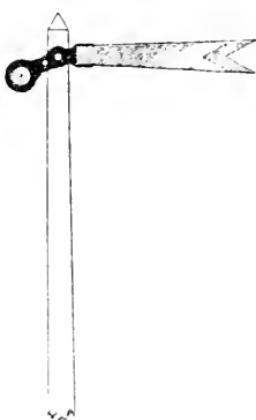


FIG. 6.

Distant Semaphore Signal.
(Horizontal, meaning stop at the
Home Signal.)

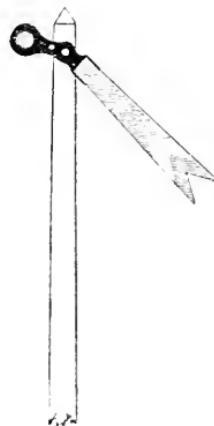


FIG. 7.

Distant Semaphore Signal.
(Pulled down, meaning proceed.)

means to the engineer, "there is a train in the block; you must proceed with caution, expecting to meet it." In England, because the permissive block has practically gone out of use, the distant

signal is always called a distant signal, and never a cautionary signal. It is painted the same color as the home signal, and displays the same colored light at night as the home signal, although the signal has a fish-tail end and so differs in respect to form from the home signal.

It does not require much thought to see that these two meanings of the distant signal are wholly different and distinct, not to say somewhat inconsistent. In its use as a distant signal it simply repeats the position of the home or the stop signal, forewarning the engineer of the position of the stop signal, which he may or may not be able to see, but the cautionary signal, as used in this country, means to the engineer that he must proceed with caution expecting to find a train in the block. In the automatic block signal system as it has been frequently introduced in this country, it is common to put a distant signal on the same mast as the home signal. The distant signal in this case is a distant signal, and not a cautionary signal, for it means not that there is a train in the block in advance, but that

the next block signal at the beginning of the block beyond, is at danger or stop. In other words, it does not, if displayed horizontally, mean to proceed with caution expecting to find a train in the block, but it means that the block signal next in advance of this one is at danger or stop. It is obvious, therefore, that with the further introduction of the automatic block signal, and with the discarding of the permissive manual block system, except with a written order or printed card, the cautionary signal must go, and the distant signal alone remain.

As explained in the beginning of this lecture, the reason the semaphore signal was first introduced is that it could readily be seen at great distances. This is true regardless of the color it is painted, and, in fact, at a distance the color of a signal of this form is not distinguishable. If seen in shadow, it appears dark gray, or nearly black against the sky, and if seen in bright sunlight it appears a lighter gray. The principal arguments for painting signals of the semaphore type is so that engine and train men may better recognize

and understand them at close range. Thus the face of the signal, or the side from which it is to be interpreted, is always painted a distinctive color, red for home or stop signals, green for distant signals, or, as I said, on some roads, lemon color for the face in both cases. The back of the signal, or the side from which it is never to be interpreted, is always painted white with a black band across it. The semaphore post or mast is usually painted white or yellow with black trimmings at the bottom, and black on all iron work.

The importance of placing signals so that they can readily be seen at considerable distances has not been as fully considered in this country as in England. Here, the usual rule is to make semaphore masts of a standard height, so that the signals shall be displayed at a standard height above the rails, usually about 20 feet for a single signal or for the lowest one of two, and 4 feet higher for the next signal above it, in case there are two signals on the mast. This seems a convenient and good rule, but there are

times when exceptions should be made to it. This is illustrated by the English practice of "sighting" signals. There, before the signals are set, the signal engineer is required to determine the position and height of the signal with a view of making it readily visible at considerable distances, and obtaining a good background for the signal. Sometimes artificial backgrounds are built behind signals, and not infrequently signals are placed on masts as high as 40 to 50 feet, with a repeating arm close to the ground, so as to enable the engineer to see the arm high in the air, or near the ground, at all times.

Dwarf signals are used to a considerable extent on slow speed tracks in freight yards, and for "back up" signals on main lines. As their name implies, they are simply miniature semaphore signals which can be conveniently located between tracks without causing serious obstruction.

The development of the interlocking machine is an interesting study in itself, and I will only indicate the line of progress. As explained already,

the embryo interlocking machine was a very simple affair. Each switch and each signal was handled by separate levers and a simple mechanical device made to interlock them. It was soon found that there was enough lost motion or spring in the parts to make it possible to give a clear signal when the switch points with which the signal was to operate were not in proper position close to the stock rail. This made it necessary to use a separate "lock" or "plunger" to lock the switch in both positions for the main or for the side track. This considerably increased the number of levers necessary to handle the ordinary switches about a junction point, thereby increasing the cost of installation and making the manipulation both clumsy and slow. This led to putting several switches or locks on the same lever; for example, throwing both ends of a cross-over with a single lever, and this process of hanging additional switches and locks on the same lever greatly simplified the locking arrangement in the machine, but, on the other hand, made the work

of throwing the levers more difficult. Development along this line continued, however, and in many cases locks and detector bars were thrown with the same lever that handled switches, using an ingenious device, known as a switch and lock movement. Along the same lines several signals were frequently operated by a single lever by various ingenious devices called "selectors," and these are still in use to this day in several forms, although less popular than at one time, as they are open to certain serious objections. The process of combining various movements, and thus centralizing in one machine the handling of many switches, some of them at considerable distances from the operating tower, went so far that it was found in some cases that something more than man power would be required to throw the levers, and hence at complicated junctions and at many terminal stations the actual movement of the switches, locks and signals is effected by hydraulic pressure, air pressure or electricity; the operator simply manipulating the valves controlling the power. The interlocking machine of to-day, whether

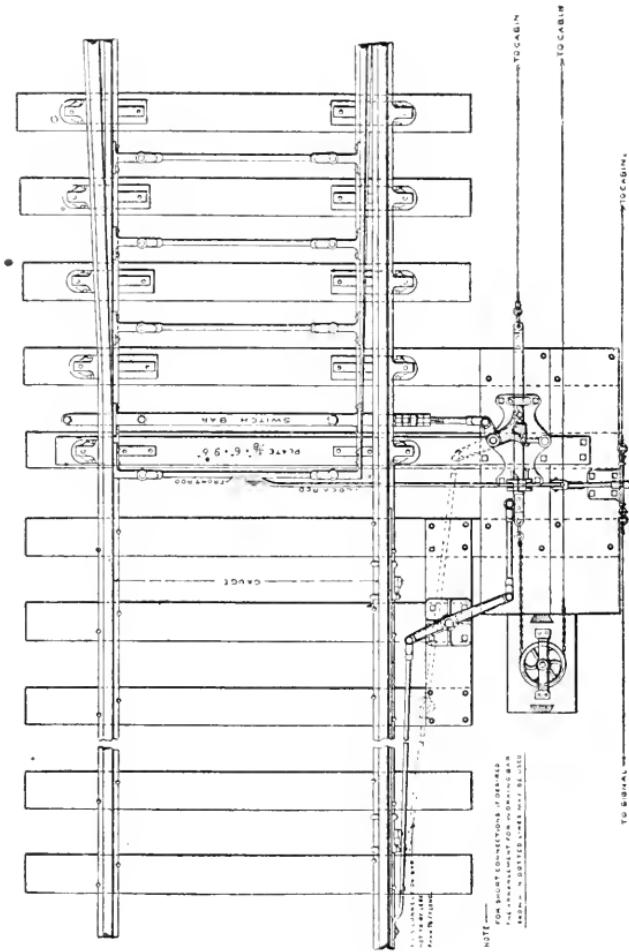


FIG. 8.
Showing arrangements for throwing a switch, together with Detector Bars, Locking Bars and Switch and Lock Movements.

purely manual, or operated with the assistance of power, is a great improvement over the older machines, and the improvement has been entirely in the direction of greatly simplifying the interlocking in the machine in the manner already indicated, and by simplifying and strengthening the design of various moving parts.

The development of the automatic block signal, which, as already indicated, represents the highest state of the art in block signaling, has been the result of an immense amount of ingenuity. Various plans, more or less successful, have been devised by which a signal at the entrance of a block is displayed at danger by the entrance of a train into the block, and cleared again by the departure of the train at the other end of the block. The consensus of opinion seems to be that none of these devices are satisfactory, except those which make use of an electric current passing through the rails of the track in what is called the "track circuit," the reason for this being that no treadle or track instrument can properly provide for the emergency of a "break-in-two," whereas with a

track circuit, a single pair of wheels left in the block will hold the signal at danger as effectually as if the entire train was there. The track circuit has the further advantage of showing a danger signal if the line is blocked by a broken rail, a wash out, or a burned bridge, which is in itself a very important feature.

Briefly, the principle on which a track circuit works is this: The rails at the beginning and end of the block are insulated from the track adjoining. This is effected by wood or indurated fibre joints; then the rails within the block are bonded or electrically connected by means of track wires, because the angle bars can not be trusted to carry the current. At the farther end of each block is located a track battery, consisting of say two gravity cells which supplies the current for the rails and the track relay. Each pole of this battery is connected to one line of rails and at the near end of the block the two lines of rails are connected with the poles of a track relay. When the track is in its normal condition, no rails broken, all switches set for the main

route, and no train within the limits of the block, the current will flow from one pole of the battery through one line of rails, thence through the track relay and the other line of rails, back to the other pole of the track battery; but if a rail is broken, or a switch misplaced, or a train or any part of a train is within the block, the current from the track battery, which is very light, is prevented from reaching the track relay, and the track relay, which has comparatively high internal resistance, remains unexcited. When the track relay is excited, a circuit is closed in the signal circuit operated by a battery located at the signal, and the operation of this is so arranged that so long as the track relay remains excited and the signal circuit complete, the signal will be held at safety or all-clear, but if from any cause the track relay is unexcited, the armature bar is released, the signal circuit broken, and the signal allowed to go to danger or stop by gravity. This is the track circuit in its first and simplest form. In recent years it has been modified so as to make the automatic signals remain nominally at danger

and go to the clear position in advance of an approaching train, if the block into which the train is entering is clear and the track unbroken.

There are several methods of operating the signals themselves. Those most commonly in use make use of air pressure, or of an electric current, either operating on the signal directly, or through an electric motor. In the first case, the signal circuit simply operates to open and close valves while the air pressure does the work of moving the signal; in the second case, the signal must be made very light and almost perfectly balanced, and incased in a weather-proof frame, thus precluding the possibility of the use of an ordinary exposed semaphore, so that the signal circuit may operate it; but in the third case, the signal circuit simply opens or closes a switch for a dynamo current operating through a small electric motor located on the signal post, operating the signal by means of an ordinary rack and pinion.

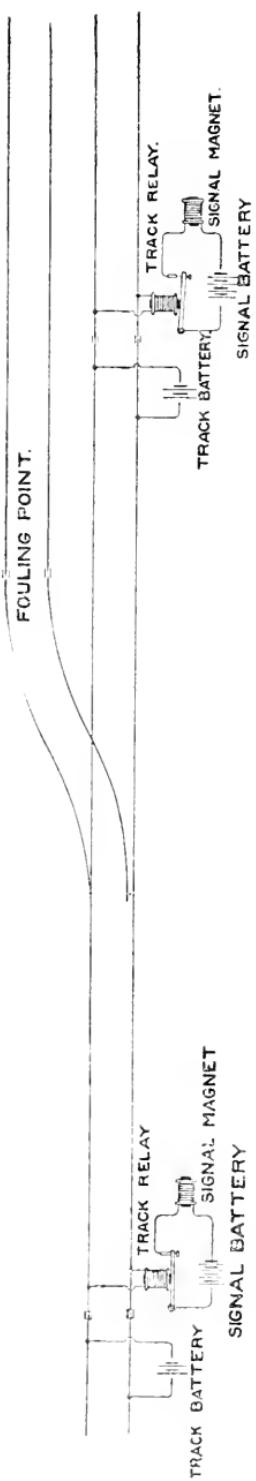
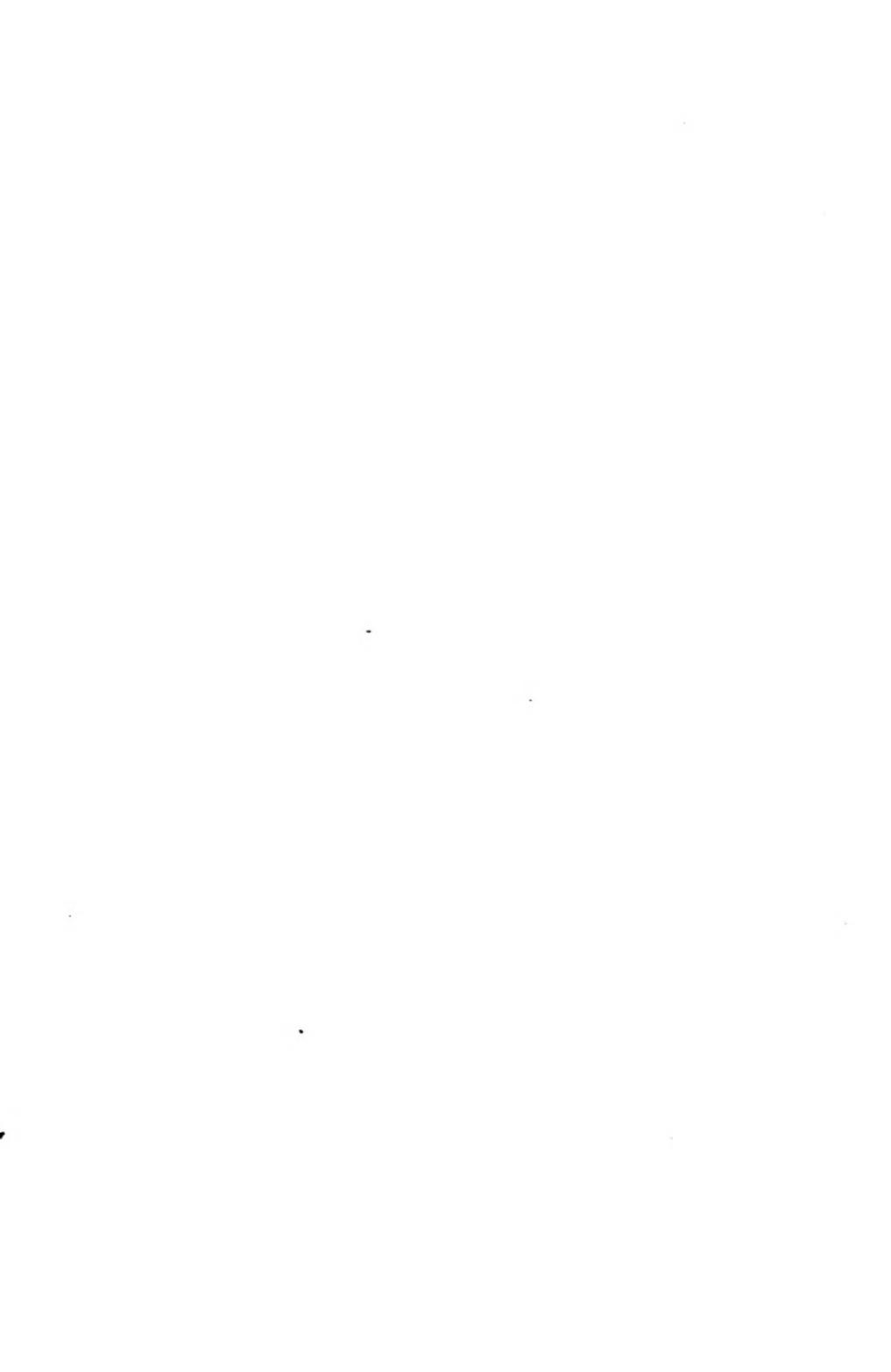


FIG. 9.
Track circuit in its simplest form,



XI.

CAR DESIGNING AND CONSTRUCTION.

ARTHUR M. WAITT.

SO far as my information goes, in the past little or no attention has been given to the elements or principles of car design and construction in the instruction given to young men in our technical institutions, and it is gratifying, and to my mind a sign of progress, that Purdue University, in outlining a course in Railway Engineering, has given to this important but greatly misappreciated feature of railway operation its due consideration.

Few of those of us who have had the good fortune to have the benefit of a mechanical training in a technical school, but have sought to

obtain as thorough a knowledge as possible of the fundamental features of locomotive design and operation, but until coming in actual contact with the railway service we have been in complete ignorance of the vast extent of the problems of car design, construction, maintenance and interchange. It is to be hoped that the graduates in Mechanical Engineering in future years, who may choose railroading for their career, may be more fully equipped for handling the perplexing problems which confront the mechanical superintendent in the car department work, as well as the locomotive department.

When the statistics, found in the 1897 issue of Poor's Manual, show that in 1896 there were on American railroads 36,080 locomotives, 32,627 passenger equipment cars, and 1,189,927 freight equipment cars, and when it is considered that the locomotives, as a rule, are continually running on the home road, while the vast number of cars are largely moving on foreign roads, often-times never being in the shops of the home road for months and sometimes years at a time, it will

be seen that the problems which confront the mechanical superintendent, in connection with the maintenance of his migratory car equipment, are likely to be much more complicated and arduous than those arising in the maintenance of the smaller number of locomotives which are constantly under the watchful care of the road most interested in them. From the fact that the cars have to be maintained and repaired by foreign roads far removed from the lines of the owning company, it has become necessary in their design to so construct them that they can readily be repaired at the shops of foreign companies. In order to bring about this result an organization was formed, some thirty years ago, called the Master Car Builders' Association. This Association was composed of representative men in charge of the car departments of the leading roads in the country. Their primary objects were to agree upon methods and bases of exchange of cars between the different roads, and in conjunction with that to carefully consider and adopt, where possible, standard shapes and sizes to be used by all companies

for parts of the cars which were most liable to breakage, and would have to be most frequently renewed by foreign roads. This Association is still in active operation, and is one of the most important and influential of the railroad associations now in existence. At its yearly convention the best mechanical minds in the railroad service gather to consider advance steps in connection with the most practical methods of car interchange, car design and the adoption of standards. The proceedings of this Association furnish the best condensation of the forward movement in car construction and design that can be had, and I would recommend the perusal of its reports and discussions to any of you who wish to become conversant with up-to-date practice in this line of work.

It will be my endeavor in the time that is allotted to me to convey to the young men before me, in a somewhat elementary manner, some of the important features of car design and construction, with which some of you may be confronted in the near future.

The primitive railway coach for transporting passengers resembled a small log cabin on wheels, the wheels having flanges to guide the car on the track. The primitive form of freight car was simply a platform carried by four flanged wheels. These crude forms were soon superseded by substituting a stage coach for the log cabin, and a wagon for the plain platform. From these simple beginnings there have been gradually developed the elegant palaces on wheels in which we ride at ease in these last days of the nineteenth century, and the multitudinous variety of freight cars, suited in detail to the numerous classes of freight to be hauled. All of the primitive cars were of the four wheel variety, but now, except for a few special uses, none of this type are built. It is needless on the present occasion for me to take the time to trace in its rapid advance the various stages of progress in car construction and design, as there are books in print giving this information in detail open to every one.

I desire now, in a brief way, to place before you some of the elements in the construction of

the prevailing types of cars used in this country at the present day. Cars may be divided into two general classes, passenger equipment and freight equipment.

Of the former the principal varieties are sleeping, parlor, dining, cafe, coaches, baggage, mail and express cars, and combinations of the above. The latter may be divided into box or house, stock, gondola, coal and flat cars, of each of which there is an almost endless variety, suiting the cars to the special class of traffic for which they are used.

CAR DESIGNING.

In designing railway cars the mechanical engineer is met with a series of problems far different from those found in the design of any stationary structure. With stationary structures, like buildings and bridges, there are well known formulæ on which to base calculations as to the proper size of materials to be used, but in the case of a car moving in a rapid train, sometimes over rough tracks, around curves and over

frogs and switches, and subject to the severe shocks and jars incident to railway service, there are no rules or formulæ which can be used in designing the work. Experience, observation, the experience of others, and good judgment, are the principal factors which it is necessary to rely upon in car design. To one in practical railway service, the frequent inspection of the scrap pile will give valuable data to assist in eliminating from a car weak features in its construction. Cars being structures subject to such unusually severe usage, necessarily require frequent repairs and renewal of parts, hence in designing great consideration must be given to so construct as to provide for ease in maintenance and repairs, as well as strength and symmetry in the first construction.

As cars do not remain always on the home road, but are dispatched to all parts of the country, and require repairs in shops many miles from the home road, it is desirable, as far as possible, to have uniformity in dimensions and shapes, so that no unnecessary expense or delays in getting

material may occur when a car has to be repaired away from home, hence the use of the so-called Master Car Builders' standards, as far as possible, should be a fundamental principle in the car builder's mind.

DIMENSIONS AND CAPACITY.

With cars of the present day, there seems to be no limit to the variety of sizes and capacities. In passenger service the sleeping cars have now reached a length of eighty feet over all, and between ten and eleven feet wide, while passenger coaches and baggage and mail cars range from forty to sixty feet over all, according to the necessities of the roads. In freight equipment the cars vary from about twenty-eight up to fifty feet in length, varying according to the possibilities of gaining extra tonnage by the increase in dimensions of cars a few inches in length, width or height, above that of a competitor. Many efforts have been made to obtain uniformity in the general dimensions of freight equipment, but little has thus far been accomplished. It has been agreed by the

American Railway Association that for general traffic box cars should be limited in size to thirty-seven feet in length, nine feet one inch in width over sheathing, nine feet in height from bottom of sheathing to top of eaves, and should have a maximum capacity of sixty thousand pounds. For special lines of traffic these limits are often exceeded.

Railway cars may properly be considered as consisting of two principal parts—a platform or superstructure called the body, and a set of wheels with their necessary controlling frame work of wood or metal, called the trucks.

In giving a running description of some of the more essential features of car construction, as there is a wide difference in detail between passenger and freight equipment, it may be best to consider some of the more important features of freight equipment cars, this class of cars being by far the most numerous, the most frequently designed by the railway mechanical superintendent, and having in them the foundation principles from which passenger equipment cars were evolved.

FREIGHT CAR BODIES.

Sills: The foundation or floor frame of freight cars usually consists of from six to eight longitudinal sills. (See Fig. 1.) There are two side sills of proper length made of either yellow or Norway pine. These are generally from eight to nine inches deep by from four to five inches wide, and in cars like flat cars, having no superstructure to help carry the load, they are made twelve and even fourteen inches deep. In the center of the floor frame are two center sills, usually of yellow or Norway pine, spaced from four to ten inches apart, and made from four to five inches wide and from eight to nine inches deep. Between these and each side sill there are usually placed one or two intermediate sills of the same material, from three and one-half to five inches wide and from eight to nine inches deep, spaced conveniently to suit the general design of car. At each end of the frame is an end sill, usually made of white oak, from six to eight inches thick by from eight to

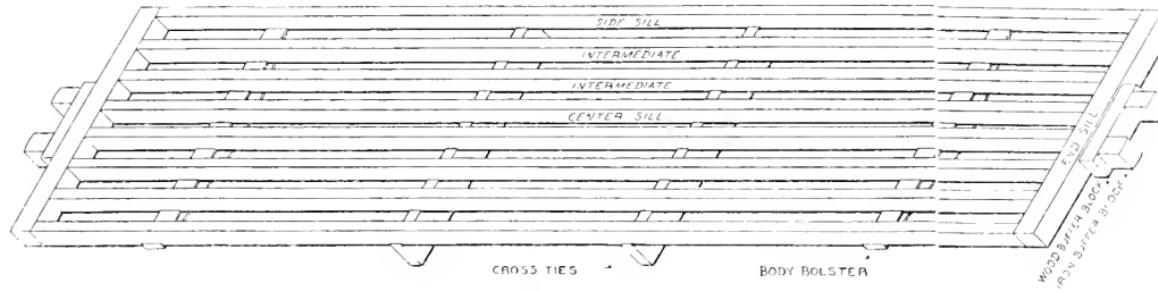


FIG 1

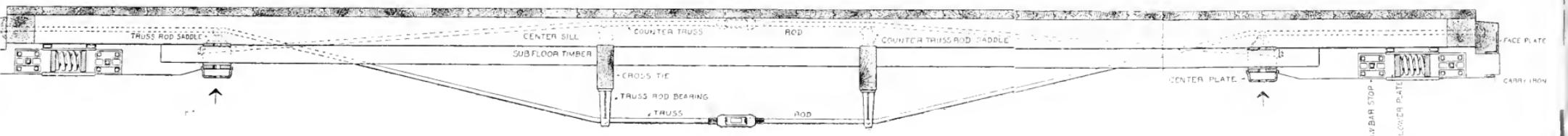
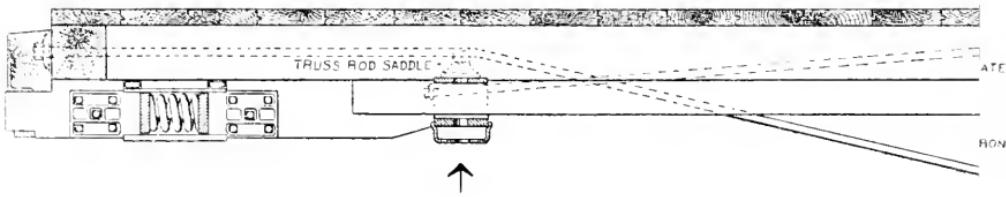
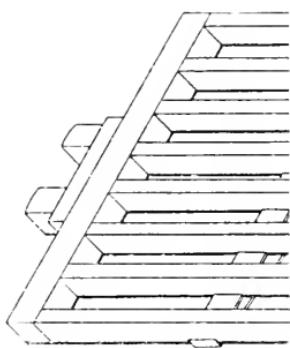


FIG. 2.



nine inches deep, extending clear across frame, and into which all the longitudinal sills are framed, generally with double tenons.

Cross Tie Timbers: Near center of car, spaced from five to nine feet apart, are generally located two cross tie timbers of white oak, from three and one-half to four and one-half inches wide by from six to ten inches deep, and extending from outside to outside of side sills. (See Figs. 1 and 2.) These timbers are securely bolted to the under side of the sills, and are generally gained out one-half inch or more deep to receive the sills, thereby holding the sills at their proper spacing, and serving also to transmit equally to all the sills the support furnished by the truss rods, as will be explained later.

Body Bolster: The support given to the car body by the trucks is transmitted by means of body bolsters, located usually about five feet from each end of the car. (See Figs. 1, 2 and 3.) The bolsters are usually iron trusses composed of a top or tension member from six to ten inches wide by from five-eighths to one inch thick, and an inverted arch compression member of the same

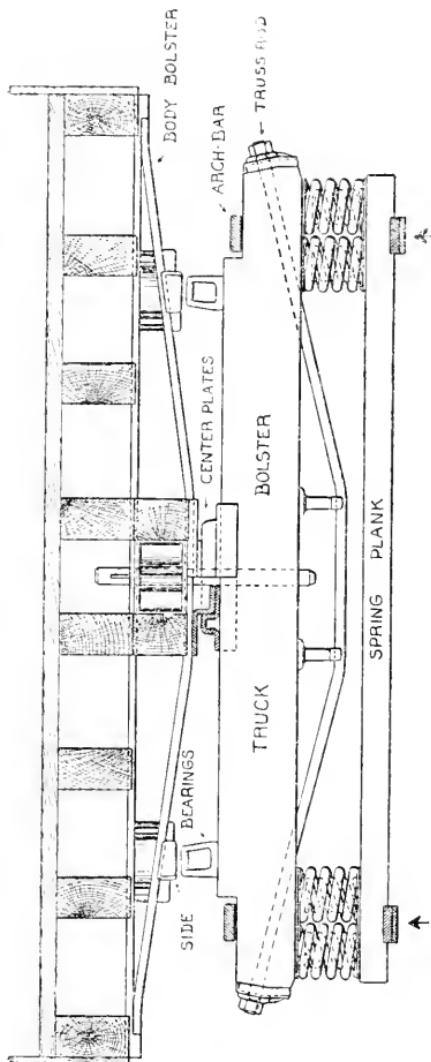


FIG 3

width and from seven-eighths to one inch thick. The body bolsters generally have both members below the sills, but sometimes in more recent design, the top or tension member is located on top of the sills, the truss enclosing the sills, thereby obtaining a deeper and much stiffer truss. Where both members are below the sills, there is an arch of from five to six inches between the members. The bolsters extend from outside to outside of the sills, and the sills are oftentimes notched or gained out to receive the top member. Body bolsters are securely bolted to all the sills. These bolsters are sometimes made compound in form, that is, instead of one wide bolster, two narrow ones spaced a foot or more apart are used. At the present time many patented styles of construction from rolled and pressed steel shapes are being put upon the market, all of which have more or less claims for consideration, but which the limits of this talk will not permit describing.

Center Plates: In order to permit the proper easy swiveling of the trucks when passing around curves, and when bearing the weight of the car

body, circular bearing center plates are interposed between the car body and trucks to transmit the load. (See Figs. 2 and 3.) These are made of cast or malleable iron or pressed steel, the truck center plate being concave or cup shaped to receive the convex or projecting part of the body plate. The center plates are shaped so as to keep the car body from getting off its center, as well as to provide for the easy swiveling motion. The body center plates are secured by bolts or rivets to the under side of the body bolsters.

Side Bearings: In order to keep the car body from oscillating under various conditions in service, it is necessary to provide additional points of contact between car body and truck, and about thirty inches each side of center plate, side bearings are provided. (See Fig. 3.) These are usually made of cast iron or pressed steel, the body bearings being secured to the body bolster and the truck bearings to the truck bolster; usually they are adjusted so as to have from one-half to one inch opening between them. Sometimes the bearings are made with rollers in them to assist

in relieving the friction while the bearings are in contact when the cars are going around a curve.

Center Pins: To make the connection between body and truck more complete, and to provide against the body center plate jumping out from the truck plate, a center pin of round iron about one and one-half to two inches in diameter, extends loosely from the top to the body bolster down through the body and truck center plates and projects through the truck bolster. (See Fig. 3.) These pins have a proper head or key at the top to prevent their dropping down.

Body Truss Rods: In order to carry the load in flat cars, and also to act as an auxiliary support to take care of unusual strains in other styles of cars, from two to four truss rods of from one inch to one and one-quarter inch round iron are used. (See Fig. 2.) These generally extend from outside to outside of end sills, having a suitable bearing on top of body bolster, and passing under and resting in castor malleable iron truss rod bearings, secured to under side of cross tie timbers. Truss rods usually have the ends upset, so that the strength

will not be too greatly reduced by cutting the thread for the nut which secures each outer end, and for the turnbuckle with which each is provided in the middle. These turnbuckles are used for convenience in applying and removing truss rods, and to provide an easy way to tighten up the truss when the car settles, or when it is desired to camber it. On flat cars which have no superstructure, counter-truss rods (see Fig. 2) have to be provided in order to prevent them from buckling and breaking in two, when they have no lading and are subjected to the crushing strains due to being placed between heavy cars in trains. These are generally two in number of one or one and one-eighth-inch iron, and extend from body bolster to body bolster, passing over suitable bearings near center of car, the bearings being located as near top of sills as possible.

Camber: In setting up that portion of the car body so far described, it is always the practice to slightly camber the frame upward by tightening up on the truss rods, so that when the car is under heavy load it will not sag enough to bring the body

straight or below the straight. By thus cambering the car from one and one-quarter to two inches, the sills are kept, as they should be, compression members of a truss, and therefore in a position to do most effective service in sustaining the load on the car.

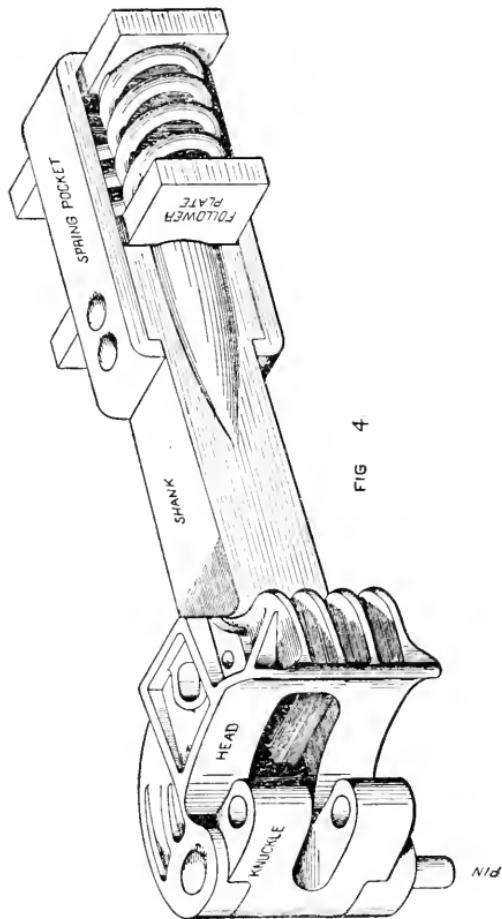
Flooring: Freight car floors are generally made of yellow or Norway pine, though occasionally white oak is used. Floors are laid across the car from side to side, and are from one and one-half to two and one-half inches in thickness, according to the service in which the cars are used, and the boards are from six to ten inches wide, and are either tongued and grooved or lap jointed. The boards are all securely nailed to each sill.

Draft Rigging: One of the most important, as well as the most frequently damaged part of a freight car, is the draft rigging. The prevalent style of such rigging is composed of draft timbers of white oak, from four to five inches wide, and about eight inches deep, bolted securely underneath each of the two center sills, and extending from the outside of the end sill, or buffer block,

back to the body bolster, and in some cases through the body bolster from one end of the car to the other. (See Fig. 2.) In the latter case they are often divided into five separate lengths, one from each end sill to bolster, one from each bolster to cross tie timber, and one between cross tie timbers. To the inside faces of these draft timbers, spaced about eleven inches on each side of a center line, which is located about twenty-four and one-half inches back from outside face of wooden buffer block, drawbar stop castings are located ; these are castings about six inches wide, ten and one-half inches long, and two and one-quarter inches thick, conveniently cored out to avoid unnecessary weight, and securely bolted to draft timbers and tied together at top and bottom by tie pieces of about two and one-quarter by one-half or three-quarters wrought iron, the whole forming a pocket on each draft timber about eleven inches long, six and one-quarter inches wide, and two and one-quarter inches deep. Between the draft timbers, with ends resting in these pockets and

supported by the bottom tie piece, are two followers, generally made of solid wrought iron one and one-half inches thick, and from eight and three-quarters to eleven and three-quarters inches long.

Between these followers is placed either a single draft spring, or, in some cases, two draft springs side by side. The draft springs are generally two coil spiral springs about five and one-half to six and one-quarter inches in diameter, and eight inches long, having a capacity of from 16,000 to 19,000 pounds. Enclosing the followers and springs, so they are kept in place and close together, is a wrought iron pocket of necessary size, made of about four inch by one inch iron, the front or open end of the pocket encloses and is firmly bolted or riveted to the rear end of the coupler casting in such a way that coupler, pocket, springs and followers are in one compact and solid group. (See Fig. 4.) It will be perceived that when the draft springs are compressed, the followers are free to move in the direction of the compression, the whole being upheld and guided by the bottom tie piece previously referred to. The couplers



now used, in accordance with United States statute, are known as the Master Car Builders' type. The coupler extends from the outer follower forward to the outer end of the car with the main part or head extending out beyond the end sills and its projecting wooden buffer block. The outer end of the coupler is supported by a carrier iron, three or four inches wide by about three-quarters of an inch thick, which passes under the shank of the coupler, and is securely bolted to the under side of the end sill or wooden buffer block. It will be seen that the coupler is secured to the car body by means of a spring cushioned attachment, which relieves the body from the severity of the various shocks received in pulling and pushing in service. In connection with the draft rigging many patented devices are in the market, having, in most cases, as an object the substitution of malleable iron or steel for wood, and the consolidation of as many separate parts as possible into one piece, and providing the best possible resistance to the alternate tension and compression

strains which are so destructive to the draft rigging.

The M. C. B. type of coupler, with the general shape of which you are doubtless all familiar, is made with a thousand and one different locking devices of various degrees of merit. The essential features are a movable knuckle, which, when released, allows the couplers to pull apart, and when closed will lock automatically and keep the couplers securely attached. The contour lines of the locking faces of the couplers and knuckles are all made to a fixed standard, adopted by the Master Car Builders' Association.

Stake Pockets: On the outside of the side sills, and also on the outside or inside of the end sills, are located stake pockets, about seven to ten of them, equally spaced, on each side sill, and two or four on each end sill. These stake pockets are either castings or of pressed steel of U-shaped section some six or eight inches deep, with an opening large enough to receive the end of a stake having a section of three and one-half to four and one-half by four to five inches. Oak or pine stakes of

required height are driven into these stake pockets for a skeleton side and end, to prevent any high load of movable freight from slipping off when the cars are in service.

The parts of cars so far covered in this talk, with the exception of the stake pockets, are applicable in general to all styles of freight cars, and aside from numerous minor parts, which lack of time prevents mentioning on this occasion, constitute the main features of the construction of a flat car. On such a foundation, box, refrigerator, gondola and stock cars are built.

GONDOLA CARS.

The gondola car is constructed on the flat car body by simply erecting sides and ends, securely fastened together. The frame for the gondola car sides and ends consists of white oak stakes, fitted and driven into each stake pocket, the stakes being at the bottom about five inches deep and tapering to about four inches at the top, the length varying according to the height of the sides.

These are usually from three to five feet high. To the inside of the stakes, planks of yellow or Norway pine, from two and one-half to three and one-half inches thick are bolted, the planks running lengthwise of the car ; the width of the planks varying from ten to twelve or more inches, as convenience may dictate. The top edges of these side and end planks are usually protected by a strip of three-eighth-inch thick iron, fastened down with lag screws.

Such is the general construction of the gondola car. Many variations of this car are constructed, some having the ends made in form of a gate hinged at the floor, so they can swing down and rest on the floor ; others have the ends to lift up, being guided and held in place by suitable grooves and guide plates. In some cases there are hinged doors constructed in the floors, which can be dropped down for convenient unloading of coal, ore or other similar freight. In these cases there is a suitable mechanism provided for closing or winding up the doors from the outside of the car. Such cars are called drop door or drop bottom gondolas.

Another variety is the hopper bottom car, which has a hopper formed near the center of the car below the floor, with sloping sides, and having at the bottom a door opening outward, with its proper operating mechanism. This style of car is desired in some cases from the fact that a large portion, and in some constructions, all of the lading is self unloading when the doors at the bottom of the hopper are opened. Many other varieties of this car are constructed, but those just mentioned are the more important types.

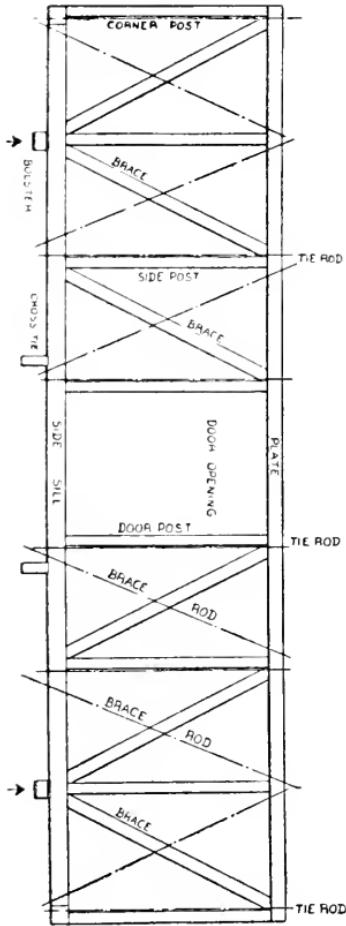
BOX CARS.

In constructing a box car the floor frame is made practically the same as the flat car, except that the side sills are, as a rule, lighter than in the flat car, the side sills being usually from four and one-half to five and one-half inches wide by from eight to nine inches deep. This decrease in the depth of side sills is made possible from the fact that the side framing of the superstructure of a box car is

made in truss form, and is well calculated to sustain a major part of the lading of the car.

Side Frame: There are many styles of side frame trussing for box cars. Perhaps the most substantial and most satisfactory style in use is the combination truss (see Fig. 5), consisting of a series of uprights or posts, with diagonal braces running between side sill and plate, from the bottom of each post to the top of the next adjacent post and having a tie rod between sill and plate at each post, and in addition diagonal brace rods, running from the top of the posts to the bottom of sills, nearly under the next adjacent posts. These brace rods, in connection with the posts, form a truss, capable of easy adjustment, and permitting the taking up of slack, and where used cars can be kept up in good shape and free from that very prevalent sign of depreciation, sagging down in the middle.

In designing the side frame of the box car, the main post is properly located directly over the body bolster, and is made generally of white oak or yellow pine; these are from four to five inches



wide, and from two to two and three-quarter inches thick, the length varying according to the height of the car. In the middle of the frame, spaced from five to six feet apart, are the door posts, forming the frame for the door opening; these are generally made of white oak, and are about four and one-half by five or five and one-half inches in section. Between the door posts and the main post over the bolster the space is divided by a suitable number of oak or yellow pine side posts into two, three, or four panels, the number depending upon the length and height of the car, and the judgment of the designer. At each end of side sill, or at each corner of floor frame, are located oak or yellow pine corner posts, which are usually about five by five inches in section. The space between corner posts and bolster post is sometimes divided by a side post into two panels, but generally it forms one panel only. The side posts are about five by two and one-half inches in section. All the posts are usually framed with tenon into the side sills, and at the top are framed into and support the side plate or top member of the truss.

Side Plates: The side plates are generally made of yellow or Norway pine; they extend from end to end of car and are about four by six and one-half inches in section. In each panel of the side frame, in the best approved style, oak or yellow pine braces, about two and one-half thick by four to six inches wide, extend diagonally, commencing at the bolster post and extending upward to intersection of next post with plate. At the side of each door, corner and side post, sometimes let in flush, are five-eighth or three-quarter-inch tie rods, extending from top of plate to bottom of side sills, tying them together. This combination of posts, braces, sills, plates and tie rods forms a complete truss of itself, but in addition, in the strongest construction, three-quarter or seven-eighth brace rods extend diagonally downward to bottom of sill from top of plate over each post, commencing at the bolster post. The combination of these brace rods with door, corner and side posts and sills and plates forms a separate truss capable of easily supporting the car and

lading. In a car constructed as above described there are three sets of trussing. (See Fig. 5.)

1. Truss rods under floor frame.
2. Post, brace and tie rod truss.
3. Post and diagonal brace rod truss.

The end frame of the superstructure of box cars usually consists of the corner posts before described and two intermediate end posts of oak or yellow pine of three and one-half by four inch section or larger. These posts extend from end sills to end plates, into both of which they are framed, the whole being tied together by the rods beside each end post. The end plates are generally of oak, about three and one-half inches wide by twelve inches deep in center, and tapering to about six and one-half inches at outer ends. End plates are framed with double tenons into side plates. In modern construction it is frequently the custom to use malleable or gray iron castings for ends of braces and side and end posts to set in, instead of having wood fitting to wood. In the end framing braces of oak or yellow pine,

about two and one-half by four to five inches, extend from junction of corner posts and sills upward to junction of end post and plate.

Roof Frame: The box car roof is usually supported by the end plates on each end, and yellow or Norway pine carlines, spaced from three feet to three feet six inches apart. These carlines are about two inches thick and about eight and one-half inches deep in center and taper to about two and one-half inches at outer ends where they frame into the side plates. The taper on carlines and end plates gives the necessary slope to the roof. When the carlines are in place the roof frame is tied together by one-half inch tie rods, let in flush in carlines and end plates and extending from outside to outside of side plates, or by strap bolts secured to each end of carlines and passing through side plates. Each carline and end plate is notched out at top about one and one-half inches deep and four to five inches wide, to receive ridge piece of yellow or Norway pine, extending from end to end of car. The ridge pieces are about one and three-quarters by five inches in section, properly tapered

to shape of roof, and are screwed or bolted to each carline. To further support the roof two or four purlines of yellow or Norway pine, about one and one-half by four to five inches, extending from end to end of roof, are located, spaced equally between ridge piece and plate; these are let into the top side of carlines and are securely screwed or bolted to each one.

Roofs: The variety of car roofs is so great that it is not practicable, within the limits of this talk, to describe them. Most of them are patented styles of construction, and are devised to protect the contents of the car from the elements, and at the same time be economical to repair, long-lived in service and cheap in cost. The plain board roof, consisting of two courses of fluted pine boards seven-eighths by six, laid so as to lap joints, is now being almost universally superseded by patented roofs.

Siding and Lining: The frames of box cars are covered with seven-eighth-inch seasoned pine or fir sheathing, tongued and grooved, and having beading or V groove at edges for finish. This

sheathing is made generally to show from four to six inches face, and is securely nailed to the plate, sill and one or two lines of side and end girths. These girths are of white oak, from about three by four to four by four in section, and extend between door and corner posts and between corner posts on ends. They are notched out so as to let them down over posts and braces and set flush with outside of posts, and are spaced equidistant between sills and plates. These are used simply for a nailing piece for the sheathing. The inside of cars is wholly or partly lined with similar sheathing, but of poorer quality, laid lengthwise of car. The varieties of door finish, of frieze and facia, trimmings, etc., is a matter of taste and experience, which takes such a variety of shapes that time will not permit of its consideration.

STOCK CARS.

In the construction of a stock car we start with the floor and upper frame of a box car, but instead of sheathing this inside and out, the car is

partially closed up on the inside by use of oak slats about five to six inches wide and seven-eighths inch thick, spaced about two and one-half or three inches apart, from sill to plate. With these cars a simple roof of single or double course of boards is generally used, it not being necessary for them to be weatherproof. Many varieties and modifications of this simple construction, suiting the cars to the special service in which they are engaged, are matters which it is needless to discuss at this time.

On the general lines that I have hurriedly described nearly all the prevailing kinds of freight equipment cars are constructed, in each case modifications being made and additions provided to adapt the general construction to the detailed requirements of many various lines of special service.

In passenger equipment elements enter into the construction which call for elaborate modifications on the simple foundation construction of a common box car. These features are so numerous and so

intricate as to require more time for presentation than I have at my disposal at present.

FREIGHT CAR TRUCKS.

A freight car truck consists of the following essential parts: Wheels and axles, journal boxes with their contained parts, truck frame, truck bolster, and springs. The special features of each of these parts I will discuss separately.

Wheels: The foundation portion of all railroad cars consists of the wheels. In freight car construction at present the wheels are of cast iron, generally thirty-three inches in diameter, and having a chilled tread about four inches wide, and a flange about one and three-eighths inches thick and one and one-eighth inches deep. The wheels weigh from 550 to 650 pounds each, and have hubs bored out from four and seven-eighths to five and three-eighths inches in diameter to receive the wheel fit of the axles. The wheel fit of axle is turned up just a trifle larger than the bore of wheel hub, the amount of difference varying with

the hardness of wheel and material of which axles are made. The fit is so close that the wheels are pressed into position on the axles under a hydraulic pressure of from 50,000 to 60,000 pounds.

Axles: Axles are made of steel or wrought iron. At the present time preference seems to be given to mild open-hearth steel, owing to the difficulty experienced in getting the iron axles to turn up in lathe free from flaws in the journals. The axles on the present 60,000 pounds capacity cars are seven feet and one-quarter inch long over all, and six feet three inches between centers of journals.

The journals are four and one-quarter inches in diameter and eight inches long, and axles are four and five-eighths inches in diameter at centers and five and three-eighths inches at wheel fit.

Journal Boxes: The journal boxes are made of common cast or malleable iron, of size sufficient to take in and cover the end of axle projecting beyond the wheel hub. The inside of box is so shaped as to receive and hold in proper position the journal bearing and wedge. The outer end of box is closed by a hinged or swing cover held

down tightly in its closed position by means of a spring. The bottom of the journal box below the axle is the receptacle for cotton, or preferably, wool packing, which is well saturated with oil, and which is pressed up close under the journal, and thereby feeds to the journal the necessary amount of lubricating oil to keep it free from heating when the car is in motion.

Journal Bearing and Wedge: The weight of car is transmitted from the truck frame to the top of the journal box, and then by means of a journal bearing and its wedge, or key, to the journal on the axle. The journal bearings are made from brass or bronze, usually in the proportion of about seven parts of copper to one part of tin; though sometimes this mixture is varied by the introduction of from one to ten per cent. of lead. The journal bearings are concave on the bottom side to fit the journal and are usually lined with one-eighth inch or more of lead, or babbitt metal, which is softer than the brass and facilitates obtaining quickly a good bearing surface between the journal and journal bearing. On the top of

the journal bearings is placed the wedge, or key, usually of gray or malleable iron or cast steel. This slips over the top of the bearing, which it loosely fits, and sets just back of a downwardly projecting lip on top of the oil box, so that when the weight of the car rests on the oil box the wedge prevents the journal bearing from getting displaced.

The proper dimensions and shapes for journal box bearing and wedge, as well as the axles, have been established by standards of the Master Car Builders' Association.

Truck Frames: Truck frames are of two general types, the arch bar frame and the pressed or rolled steel frame. The simplest and most common form of truck has the diamond arch bar frame, so called from its shape. There are two diamond side frames, connected together by a cross frame which supports the truck bolster on which the body bolster and car body rests. The diamond side frames consist of a truss, with ends resting on top of oil boxes, which are spread about five feet apart. The truss has an upwardly arched

top, or compression member, which for 60,000 pound capacity cars is made of about four by one and one-quarter inch iron. This rests at the ends on the bottom arch bar or tension member, which is downwardly arched, and made of about four by one inch iron. The maximum distance between top and bottom members is generally about sixteen inches, and they are held apart by either a center casting, or in the simpler form of truck, by two column castings of gray or malleable iron, spaced from thirteen to fourteen inches apart, and forming a guide for the vertical motion of the truck bolster, which extends across from one side frame to the other, and projects through beyond the frames several inches. The column castings or bolster guides are made hollow for taking the column bolts, which pass through from the top to the bottom arch bars, and also include the bottom tie bar, firmly securing the truss frame together near the center. The bottom tie bar is a bar of about four by five-eighths inch iron, extending between journal boxes underneath, and held in place by the column bolts and the bolts which

hold ends of diamond frames to oil boxes. In the simpler form of diamond trucks the cross frame consists of an oak spring plank about twelve or fourteen inches wide and about four inches thick, extending across from side frame to side frame, and extending a little beyond the frames.

This timber is secured by being bolted to the bottom of the column castings. In the most approved form of trucks a steel channel about twelve inches deep, with flanges about three inches deep, is substituted for the wood spring plank. In some styles of diamond trucks, instead of the arch bars having column castings between them, there are two channel irons about twelve inches apart used, connecting the two side frames to which they are well bolted or riveted; these form the cross frame. These cross channels are called transoms, and from them depend fixed or swinging supports for the springs upon which the truck bolsters rest. These transoms were formerly made of oak timbers. Where swinging hangers are used, these hangers are attached to and support the spring plank, which in such cases is a little shorter than

the distance between the side frames. Trucks having transoms and a spring plank supported by swinging hangers at each end are called swing motion trucks, and are strongly advocated by some car-builders. The general practice is to use trucks having fixed spring planks, which are known as rigid trucks. These are simpler in construction, cheaper in first cost and in cost of maintenance. As far as possible the springs are located near the ends of the spring planks and over the center of the side frames of the trucks.

Springs: The springs are sometimes of elliptic form, but usually consist of groups of helical springs, held together in a suitable case by means of light bolts. The springs are generally made of open-hearth steel, and are of a capacity which will allow them to compress from about one-half to three-quarters of an inch under the load of the car body, and from about one to one and one-half inches under the weight of car and load.

Truck Bolsters: Resting on the springs and extending across the truck, passing through the side frames and guided by the column castings, is the

truck bolster. This in its simplest form consists of a piece of white oak about nine by thirteen inches and seven feet six inches long, trussed by two one-inch iron rods resting under wood or iron center bearings below center of timber, and having nuts on the ends, bearing against suitable iron washers or end castings. Proper castings near each end act as a guide to the bolster as it moves up or down between the column castings, and prevent its having any excessive end motion. On the top of the bolsters at the center is located the truck center plate, which properly engages with the body center plate, thereby providing means for the truck to freely swivel when in motion. Also, properly spaced on each side of the center plate are truck side bearings, so located as to receive the weight transmitted by the body side bearings. In the latest designs of trucks special bolsters, either made up of rolled or pressed steel shapes or of cast steel, are used, these being more durable and being considered more economical in the long run. As these are nearly all special

patented devices, it is not best to describe them at this time.

Pressed Steel Truck Frames: A prominent competitor for consideration as a substitute for the diamond frame arch bar truck is the pressed or rolled steel type. The side frames and cross frames of these trucks are made up of either rolled or pressed steel members, very securely riveted together, so that both side frames and the cross frames are practically one rigid piece, free from bolts. As there are many varieties of this type of frame and they are all covered by patents, I will not attempt to describe them.

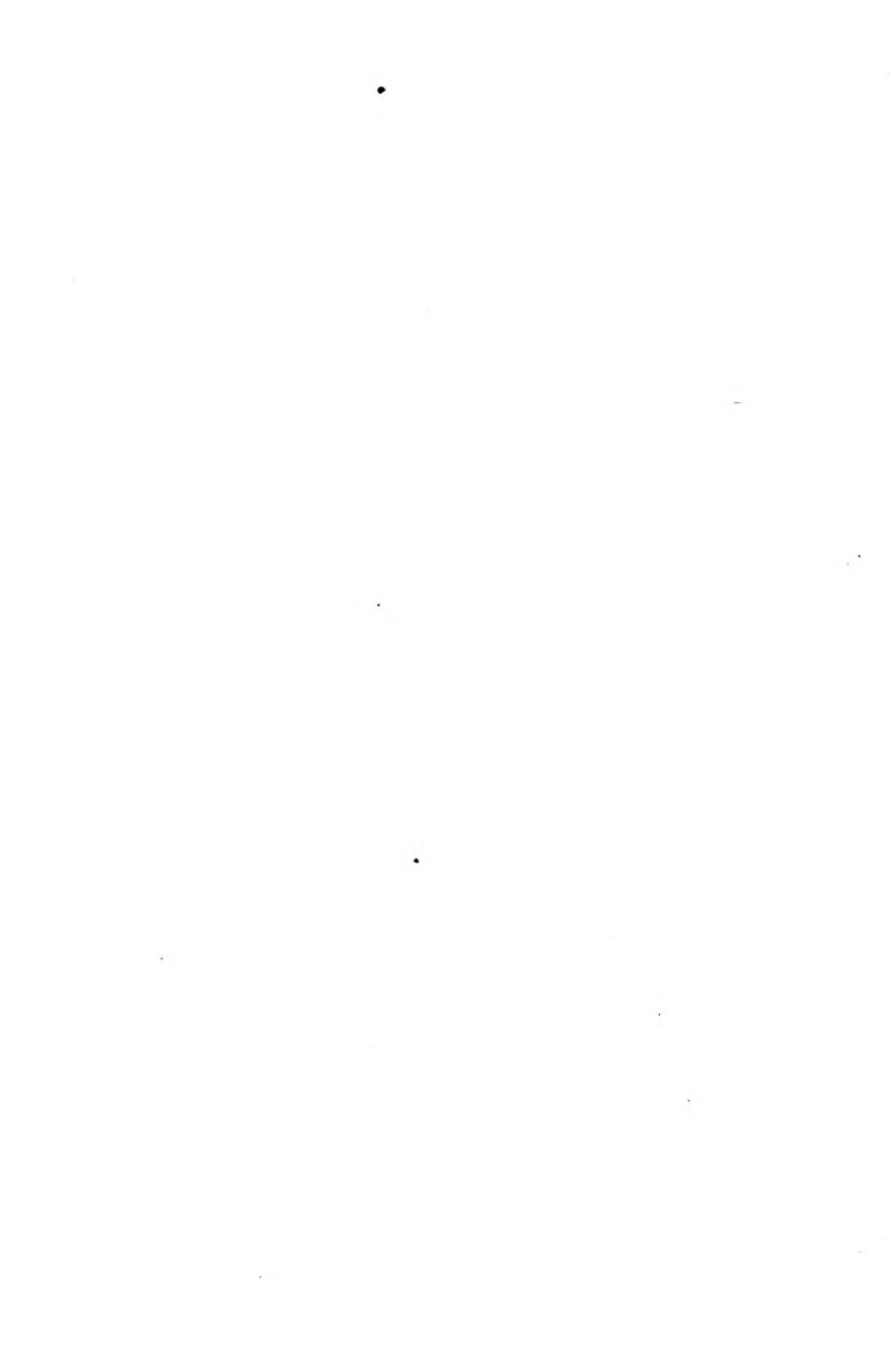
PASSENGER CAR TRUCKS.

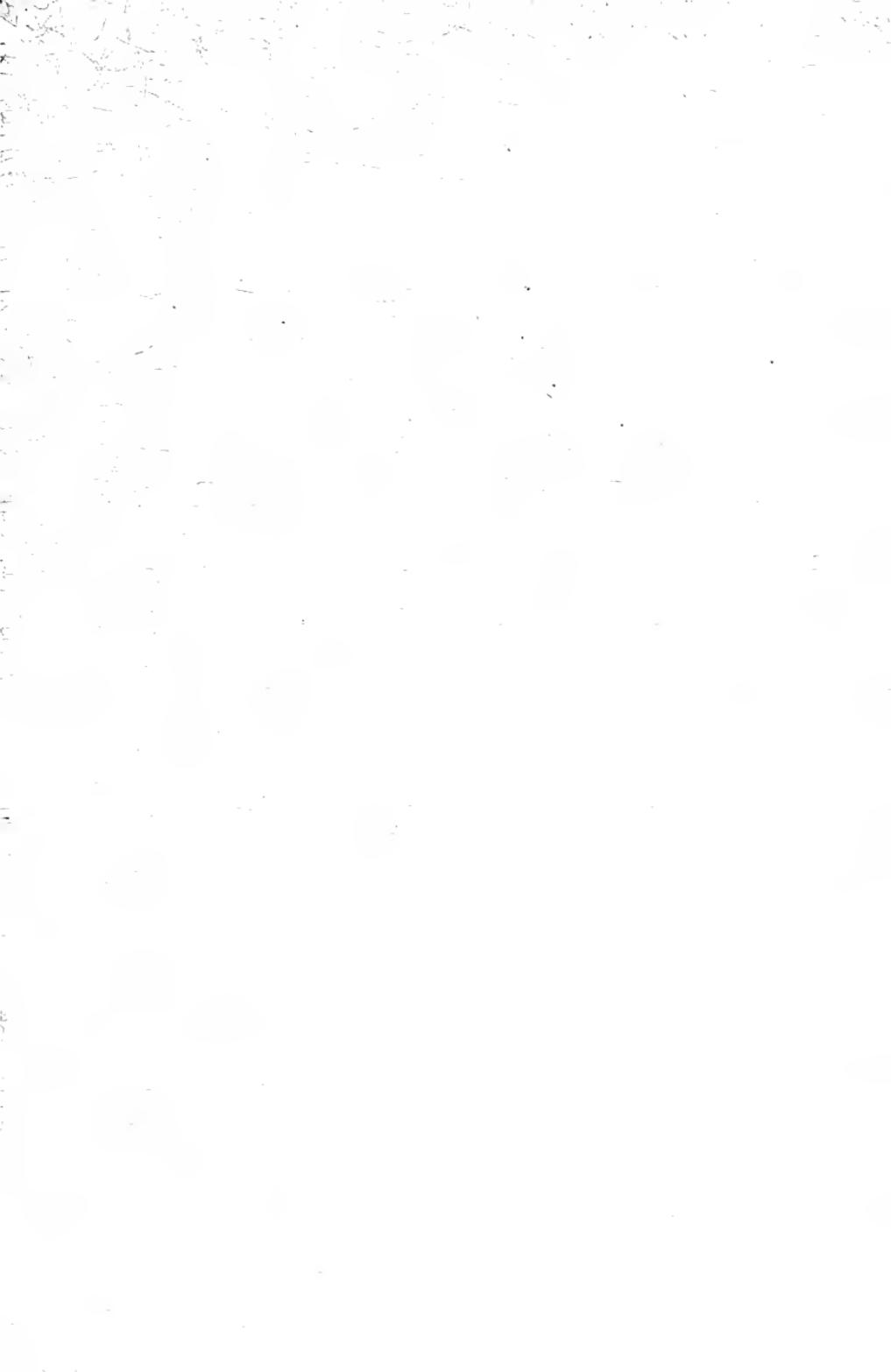
Passenger car trucks are a much more complicated structure, having, in addition to the elementary features pertaining to freight trucks, many added features calculated especially to give ease in riding. The details are too extensive to warrant discussion at this time.

Many details of car construction in the way of air brakes, safety attachments, brake beams, uncoupling rigging, etc., can not be touched upon at this time, but the student who desires to become more familiar with them can best do so by a study of the numerous articles which are appearing from time to time in the various railroad technical journals, and in the reports of the Master Car Builders' Association, as well as those of the various Railway Clubs.

There is at the present time a rapidly growing tendency to greatly increased capacity of cars and the construction of all the parts possible of steel, either in rolled or pressed shapes. As designers are considerably at variance at present as to what style of design is best from all standpoints, it may not be wise to attempt to describe any of the all-steel cars, but it may be a matter of interest to examine a photograph which I have brought of one of the latest all-steel coal cars just built by the Schoen Pressed Steel Co., of Pittsburgh. By the courtesy of the Pullman Palace Car Co., the Michigan-Peninsular Car Co., the

Barney & Smith Car Co. and the Wells & French Co., I am able to present for your examination photographs of a large number of types of car construction, showing in some cases the detail of construction.





UNIVERSITY OF ILLINOIS-URBANA



3 0112 056601674